

THE DOCK & HARBOUR AUTHORITY

No. 102. Vol. IX.

APRIL, 1929.

Editorial Comments.

LIVERPOOL'S HUGE TONNAGE.

According to the annual report of the Liverpool Steamship Owners' Association, the members of the Association owned at the end of the year 1928, 5,710,569 tons gross of steam shipping, which comprised upwards of 25 per cent. of the total British steam tonnage afloat; 36 per cent. of the total number of British vessels of a speed of 12 knots and upwards; and 33 per cent. of the total number of British steam vessels of over 5,000 tons. Dealing with the trade of the Port of Liverpool, the Association states that a total weight of 6,714,957 tons of foreign imported cargoes has been dealt with in the twelve months ended December 31st, 1928, and may be compared with a total weight of 6,764,855 tons dealt with in the year 1927. The weight of goods imported into Liverpool in 1928, therefore, shows a decrease of 0.75 per cent. on that of 1927. In the twelve months ended December, 1928, the total weight of imports into all the ports of the United Kingdom was 56,500,000 tons as compared with 61,500,000 tons in the previous twelve months, a decrease of 8.1 per cent. Mr. S. J. Lister, who presided at the annual meeting, criticised the proposals being made to bring about international uniformity of buoying and lighting of navigable channels and port entrances on the ground that they meant a radical and costly alteration without any evidence that there was real need for uniformity. In reference to dock tonnage rates in the Port of Liverpool, he said that in 1922, the Dock Board allowed a reduction of 5 per cent. both to ships and goods in respect of those rates. As from the 1st September last, the reduction was cancelled as regards the rates on ships. The Association had protested both on the ground that the taking of any step such as to bring about an increase in port charges was, in the present state of trade, to be deprecated, and also on the ground that the discrimination shown against the ship was unfair. It might well be that the level of port dues in Liverpool accounts for the fact that Liverpool appears not to be entirely holding its own in competition for through traffic.

JARROW DEVELOPMENTS.

The contract for the construction of the new railway branch line over the East End Estate, Jarrow, has been placed with Mr. John Lant, of Newcastle. Work will be begun immediately, and it is expected the railway will be completed in three months. The order permitting the construction of the railway was recently granted by the Ministry of Transport to the Mercantile Dry Dock Company, Limited. The new line will provide communication with the large oil depot close to Jarrow Slake, and it is hoped will enable the estate to be developed for new industries. Mr. J. E. Tully, chairman of the Mercantile Dry Dock Co., speaking at the annual meeting, said the Shell Mex Co., Ltd., had already arranged to acquire further land to extend their oil depot, and should the plan contemplated by the Tyne Improvement Commission for the development of Jarrow Slake come to fruition, it would have an important bearing on Jarrow's industrial prospects.

Tees Conservancy's latest statistics show that the shipments of iron and steel from the Tees in February were the heaviest since December, 1927. Pig iron loadings were 2,000 tons less than in January, but steel clearances show gratifying increases, the improvement being most marked in the shipments to South and East Africa. Of the 14,915 tons of pig iron despatched, 5,764 tons went coastwise, and 9,151 tons overseas; of the 5,417 tons of manufactured iron shipped, 1,621 went coastwise, and 3,796 abroad; and of the 70,968 tons of steel cleared, 9,272 tons went coastwise and 61,696 to foreign ports.

LOANS TO HARBOUR COMMISSIONS BEFORE CANADIAN PARLIAMENT.

A Bill to authorise a loan of \$10,000,000 to the Montreal Harbour Commission for extension of harbour facilities has been given first reading in the Canadian House of Commons. Introduction of the Bill by Hon. P. J. A. Cardin, Minister of Marine and Fisheries, was preceded by the following resolution: "Resolved that it is expedient to authorise a loan to the Harbour Commissioners of Montreal in an amount not exceeding \$10,000,000 to carry on the construction of terminal facilities, upon approval by the Governor-in-Council of detailed plans, specifications, and estimates for such works and the deposit of debentures of the Corporation to cover said loan."

Formal notice has been given of similar resolutions to authorise loans to the Vancouver Harbour Commission, \$10,000,000; Halifax Harbour Commission, \$5,000,000; Three Rivers Harbour Commission, \$2,000,000; Chicoutimi Harbour Commission, \$2,000,000.

A total of \$29,000,000 in loans to Harbour Commissions for port developments in Canada is indicated. Speaking on the Resolution respecting the proposed loan to the Harbour Commissioners of Montreal, Mr. Cardin stated that the receipts of the Port of Montreal for 1924 were \$4,000,000, and they have increased to over \$5,500,000 for the year 1928. The proposal of the Harbour Commissioners, he stated, is to provide for the enlargement of what is called the Laurier Pier in Montreal, also for the reconstruction of the King Edward Pier and the Alexandra Pier, the extension of the electrified railway system across the Lachine Canal, the extension of the grain conveyor system, industrial wharves, additional berthing facilities and the acquisition of land.

CANADIAN GOVERNMENT TO INVESTIGATE CHIGNECTO SHIP CANAL PROJECT.

The Hon. C. A. Dunning, Minister of Railways and Canals of Canada, declared in the Canadian House of Commons recently that the Government is willing to investigate the feasibility of constructing a ship canal across the Isthmus of Chignecto. This announcement followed the introduction of a resolution sponsored by Mr. R. K. Smith, M.P. for Cumberland County, Nova Scotia, that a survey of all phases of this projecting of connecting the waters of the Bay of Fundy with the waters of the St. Lawrence should be undertaken. As a result of Mr. Smith's representations the House finally approved of an immediate investigation of the feasibility, costs of construction and economic and national advantages to be gained from the construction of such a waterway.

In advocating the building of the canal across the isthmus joining Nova Scotia and New Brunswick, Mr. Smith pointed out that shorter, cheaper and better transportation facilities would result from the undertaking. The projected canal, he indicated, would lessen the distance between Prince Edward Island and Saint John by 600 miles, that from Montreal to the Bay of Fundy by 500 miles, and from Montreal to the West Indies by 400 miles, all of which meant a saving of many days.

PORT OF DUBLIN.

Situated on the east coast of Ireland and at the mouth of the River Liffey is the Port of Dublin, and this well-known port has been taken as the subject for this month's supplement.

The first recorded existence of this port can be traced back to 150 years before the Christian era, and the article takes us through the ages up to the present day, showing the various stages of improvements and extensions which have been undertaken and which have produced the Port of Dublin as it is now.

The Port of Dublin.



Transit Sheds on North Quays, showing Railway Sidings.



Alexandra Basin, present day.

The Port of Dublin.

ITS ANTIQUITY AND PROGRESS.

THE seaport of Dublin has a history which can be traced back to 150 years before the Christian era, when Ptolemy recorded the existence of the city Eblana on the Liffey. There have been many tides in Dublin Bay since then and big changes have taken place in the port of Ireland's capital. The Norsemen who invaded the country were probably the first to commence the work of the dock and harbour accommodation which the present Port Authority carries on.

Records prove that as late as 1177 the old Danish bridge—probably the first to span the Liffey—was standing, and up to it the Viking ships came to discharge their cargoes and take back goods to Scandinavia. At that time the fleets of the Norman invaders sailed up the river and subsequently a brisk trade was established between Dublin, Bristol and other English ports.

As compared with the present day the accommodation then required for shipping was very modest. In the sixteenth century

by the enclosing of the North and South Lotts, the construction of the Great South Wall from Ringsend to Poolbeg and the erection of the Poolbeg lighthouse. The necessary funds were provided by the tonnage rates or special grants from the Parliament of Ireland.

For the better administration of the port, the Ballast Office became the Corporation for Preserving and Improving the Port of Dublin in 1787. This was sanctioned by an Irish Act of Parliament. In 1867, there was a further revision, and the port was vested in the present and Docks Board which has functioned ever since, the administration of lighthouses round the coast being vested in the Irish Lights Commissioners. During this interval of 81 years the North, South and East Walls were built, the channel dredged, the North Wall was constructed, the graving dock and graving slips 1 and 2 were built; North Wall basin was begun, timber jetties were made on the North Quay; the sheds on the North Wall were erected, the Custom House Docks were placed under the control of the Port Board, and the deepening of the North Wall Quays begun.



How the "made ground" (New Port Extension) has been formed.

—in 1590, to be exact—vessels unloaded at Merchants Quay and Wood Quay, where the depth of the Liffey varied from 3-ft. to 6½-ft., yet this was sufficient for the shipping of the period. The Custom House was located near the entrance to Winetavern Street.

In 1649, according to Gerard Boate, there was but 6-ft. of water at the bar at low tide, and vessels drawing 5-ft. could not go further up the river than Ringsend, where they became stranded at low tide.

With the progress of time and the increase in the size of ships, the estuary presented serious difficulties, and numerous experts were consulted as to what should be done with regard to facilitating traders. The rivers Liffey, Dodder, and Tolka, which cut out the natural harbour, were unable to cope with the counter-action of the sea, and the water became silted up with a dangerous bar, and with shoals which increased every year. The two great sandbanks to north and south of the fairway were a peril to shipping, and received the names of the North and South Bull.

In 1676, the city merchants, headed by Henry Howard, petitioned the Lord Lieutenant for a patent establishing a Ballast Office which should have charge of dredging the Liffey. This was opposed by the Corporation, who wanted to establish a Ballast Office themselves and apply any profits from their operations to the Blue Coat School. It was not until 1708 that a Ballast Office was actually established.

In 1707 the "Old Custom House" near Essex Bridge was built, and continued in use until 1790. Nine years later, Free Trade for Ireland was achieved by the Parliament of Ireland. The duties, under the new conditions, were continued, but were imposed by the Native Parliament for the benefit of the Irish Kingdom.

At this time the well-known architect, James Gandon, was asked to prepare plans for a new Custom House on the riverfront at Beresford Place. This work was taken up earnestly, and in 1791 the fine building and spacious docks were completed at a cost of nearly £300,000.

Between 1707 and 1786, the river channel between the city and Ringsend was straightened out, and the port was benefited

In 1710 there was talk of piling on the north side, followed by reports of dredging and procuring vast quantities of store and faggots to wall the channel in. By 1715 considerable progress had been made, and at the end of that year it was decided to take the south side in hand.

To provide more shelter than was provided by the Pool of Clontarf and the anchorage at Poolbeg to the north of the old "Pigeon" House fort, the Ballast Office had a row of piles driven in order to form a sandbank. This work was started in 1717 at a point now known as "Pigeon" House Road. It was completed in 1735, when a lightship was stationed at the end of the piles where the present lighthouse was erected in 1761-68.

In 1805, according to a report by the Directors of Inland Navigation, the harbour had been so improved that it was able to receive vessels of 300 tons.

As the result of steady dredging and a study of the habits of the river and its surroundings, the bar has now gone, the sandbanks have been reduced, and a straight, wide channel has been created, this being indicated by international day-marks and well-lighted buoys at night.

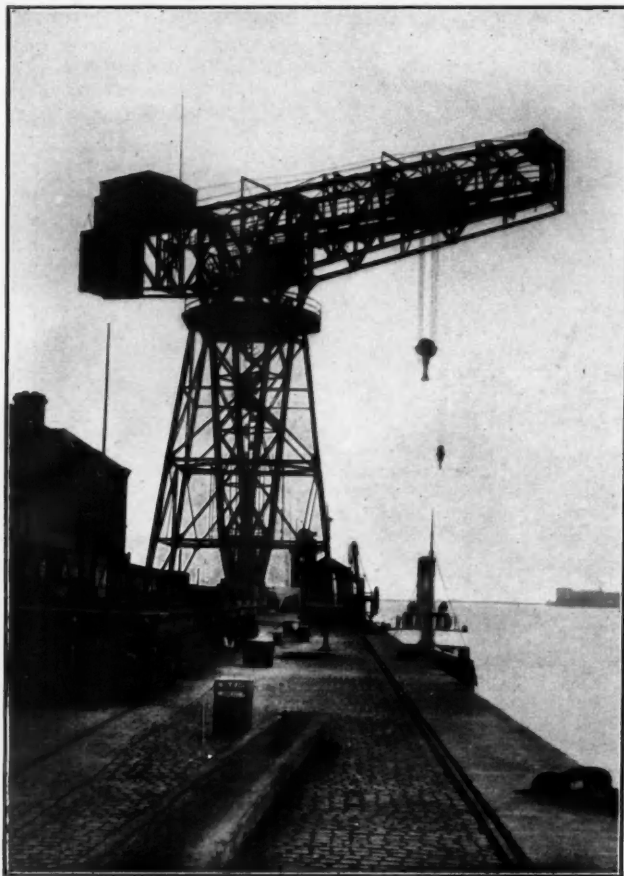
A notable example of natural tidal scour as an agent for removing river bars is afforded by the South Wall extending to Poolbeg Lighthouse on one side and the North Wall, ending in the Bull Lighthouse on the other. The entrance to the channel between them is 1,000-ft. wide.

To-day, at high tide, ships of 12,000 tons burden and 32-ft. draught can make the port of Dublin with ease. This is a big advance on the time in 1905 when the port was being congratulated on being able to berth even vessels of 300 tons. Since 1860, fifty million tons of debris have been dredged out. This has been dumped within containing walls and made into good, solid land upon which part of the city stands on the south side; while the great oil storage tanks, the up-to-date grain elevator, the milling concerns belonging to the Dublin Port Milling Co., and the ship-building yards have been erected on the reclaimed land on the north side.

Thus on the northern shore alone some fifty acres have been reclaimed, and a further area of fifty acres is to be reclaimed. In this way a series of sites with wide roads and quay facilities for rail connection and deep water frontage will be provided for manufacturing concerns and other businesses requiring water-side space. A plot of land 300-ft. by 110-ft. in the vicinity of the new deep water quay is now available for lettings.

Adjoining this is the Alexandra Basin with sixty acres of water area, and with berthage at all states of the tide for vessels of 24 and 26-ft. draught. On the north side of the basin extensions and constructions are being made which will provide berthage for the largest vessel which passes through the Suez or Panama Canal.

Pipes connect the deep-water front of the Alexandra Wharf with the great grain silo and the oil storage tanks capable of storing over 12,000,000 gallons of oil. Through these pipes the cargoes of grain and oil can be sucked from the vessels at the wharf into the storage quarters on land.



The 100-tons Electric Crane at North Wall Extension.

Other points regarding the Port of Dublin are:—Pilotage is compulsory. The Dublin Port and Docks Board, being the pilotage authority, own two pilot steamers and have a staff of experienced pilots.

The Dublin Port and Docks Board also have two tug boats in commission and undertake public towage.

RIVER BERTHAGE.

In addition to berthage in the Alexandra Basin, there is a berthage line, one-and-three-quarter miles long, extending from Alexandra Basin to the City, on the north side of the River Liffey, which is chiefly devoted to Continental and cross-channel trade. On the south side are one and a quarter miles of berthage, taken up chiefly by overseas trade, direct sea traffic to London and other cross-channel ports.

Altogether, including canal docks, there is a total quay frontage of 30,116-ft. or 5.9 miles of the area. Double or treble shift work in the discharge or loading of cargoes is possible by electric lighting of the different quays and wharves.

The quays and adjoining streets are jointly lighted by the Dublin Port and Docks Board and the Dublin Corporation, the latter body maintaining a public supply of 3-phase current, 51 cycles, for lighting 346 volts, and for power 5,300 volts. A public gas supply is maintained by the Alliance and Dublin Gas Consumers Co., the gas having the following minimum caloric value—450 B.Th.V. per cubic feet of gas. The average for three years' however, is 1½ per cent. above this value.

CRANAGE AND DISTRIBUTION FACILITIES.

The basin is equipped with a 100 ton crane with a clear lift of 75-ft. above water level. The number of cranes in the port, apart from those provided at the canal docks is 62.

At the North Wall berthages, and at the deep water quay, Alexandra Basin and cross berth, there are railway sidings and facilities allocated to the Great Southern Railways and

under its control. This Railway Company links up with other railways, and has two depots on the river front—one adjoining the Royal Canal and Spencer Docks, and the other at the North and East Wall (North Wall Extension). These depots deal with all goods, minerals and live stock passing out or in by rail.

On the Northern quays there is also available inland navigation from the Royal Canal and Spencer Docks via the Royal Canal, which connects with Tarmonbarry on the Shannon, and a branch canal at Longford.

The Southern quays are connected with the Rivers Shannon and Barrow by the Grand Canal, the eastern terminal point of which is the Grand Canal Docks in the Port of Dublin. This canal serves the ports of Dublin, Limerick and Waterford. It extends northwards to Carrick-on-Shannon and southwards to Limerick and Waterford, with branches to Naas, Mountmellick, Edenderry and Kilbeggan. Goods are carried to 55 towns, and as the company's barges are now worked by motor power traffic it has been greatly speeded up.

The docks through which the canal enters the Port of Dublin have an area of 24 acres and can accommodate seagoing vessels up to 148-ft. in length, and draught 14½-ft. Length of quays 5,300-ft. There are three entrance locks and two graving docks.

STORAGE, ETC.

Storage sheds of modern structure cover many acres. In addition there are the Custom House docks and warehouses, built at a cost of £700,000, to which there is a separate entrance from the river, and in which landing accommodation is provided for dutiable goods both in large storage sheds and in the great range of vaults.

REPAIRS.

Ship-building and ship-repairing yards are located on the north side of Alexandra Basin, while a graving dock and graving slip render repairs below water line an easy matter.

The total berthage is 19,716-ft., with a water frontage of 20,246-ft. or 3.83 miles, not including canal docks—but embracing the north and south quays.

All the railways running into Dublin are connected with the North Wall Extension and Alexandra Wharf. The south quays are linked up with the country by the Grand Canal only.

Vessels of any length or beam, and of draught up to 33-ft. can be accommodated.

The water front of the Grand Canal Docks measures 5,300-ft.

COAL BUNKERING AND FUEL OIL.

There is no recognised coal bunkering wharf at the port, but when bunkering has to be done, coal is usually carried out by the use of electric cranes or carted by the merchants to the ships and carried on board.

Facilities for bunkering with fuel oil are provided.

PRINCIPAL EXPORTS AND IMPORTS.

Principal exports include bacon, biscuits, butter, cattle, eggs, extra stout, farm produce, foreign extra stout, horses, mineral waters, pigs, sheep, stout and whisky.

Principal imports: artificial manure, barley, cement, feeding stuffs, flour, fruit, Indian corn, iron and steel, oil (including motor spirit, paraffin and petroleum), paper, sugar, tea, timber, tobacco and wheat.

LIVE STOCK.

The live stock accommodation at North Wall enables the simultaneous handling of about 3,500 head of cattle, horses, sheep and pigs. It consists of lairage, stabling, or transit pen accommodation, where the animals are watered, fed, and subjected to examination by veterinary inspectors of the Department of Agriculture to ensure shipment in good health and condition. The cattle yards are well paved, lighted and watered, and the fodder is cleanly carried in overhead iron racks.

REGISTERED TONNAGE AT DUBLIN PORT.

Excluding the tonnage of Government vessels, the following is a statement of the registered tonnage that entered the Port of Dublin for each year during the last ten years, compared with 1908:—

	Overseas Trade Tons	Coasting Trade Tons	Total Tonnage	Income derived from tonnage dues Timber, etc., rates £ s. d.
1908	341,237	1,595,803	1,937,040	74,727 4 9
				140 6 1*
1918	156,956	1,467,552	1,622,508	54,449 2 1
				1,864 2 7†
				183 3 9‡
1919	316,585	1,513,076	1,829,461	62,252 5 4
	Gross 478,152			6,377 10 11†
1920	369,380	1,569,274	1,938,654	70,957 7 2
				1,971 16 0†
1921	529,610	1,495,222	2,024,832	89,706 0 7
				1,919 15 11†
1922	509,913	1,523,843	2,033,756	89,492 15 0
				1,571 4 10†
1923	530,303	1,385,889	1,916,192	1,430 17 11†
				72,686 12 0
1924	589,631	1,682,612	2,272,443	642 17 2†
				85,115 3 5
1925	522,642	1,615,367	2,138,009	79,100 11 8
1926	736,381	1,326,265	2,062,646	79,838 13 11
1927	557,128	1,714,728	2,271,856	79,630 4 11
1928	578,837	1,710,092	2,288,929	74,677 11 11

* Net rates.

† Special payments by Admiralty on Account of dues on transports.

‡ Special payments by United States Navy on Account of dues on transports.

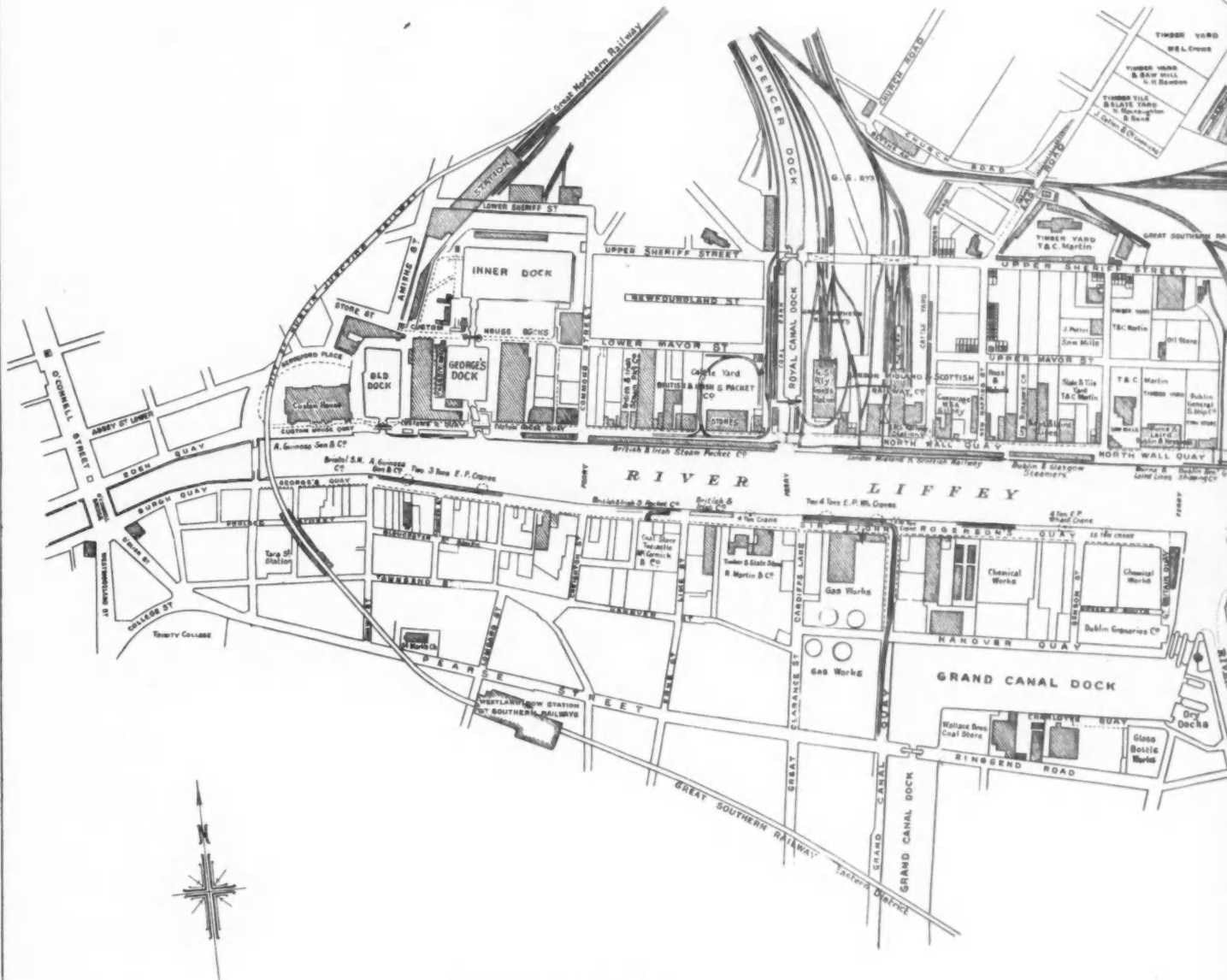
DUBLIN HARBOUR

UNDER THE JURISDICTION OF THE DUBLIN PORT AND DOCKS BOARD.

DUBLIN DOCKS.				
NAME OF DOCK	Area in Acres	Depth in Dock	Depth over Sill at High Water Ordinary Springs	Width of Entrances at Capping Level
Royal Canal Dock	1½	15'	15'	27'
Spencer Dock	4	15'	13½ to 16½	26'
Old Custom House Dock	2	14½	16'	35'
George's Outer Dock	1¾	16½	17½	35½'
George's Inner Dock	4½	16½	17½	35½'
Grand Canal Dock	24	18'	18'	35½'
North Wall Graving Dock		Length of Floor 377'	Length of Floor & Sill 408'	18' 3" 70'

GRAVING		
SLIP	Extreme Length	Length of Cradle
Nº 1	350' 0"	76' 0"
Nº 2	537' 0"	135' 0"

Notes:- Ordinary Spring Tides rise 13' above Standard Low Water of the Port which is 1.43 above Ordnance Datum.



Note:- Extensions are coloured Red.

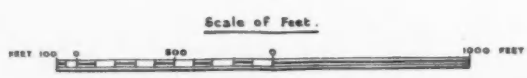
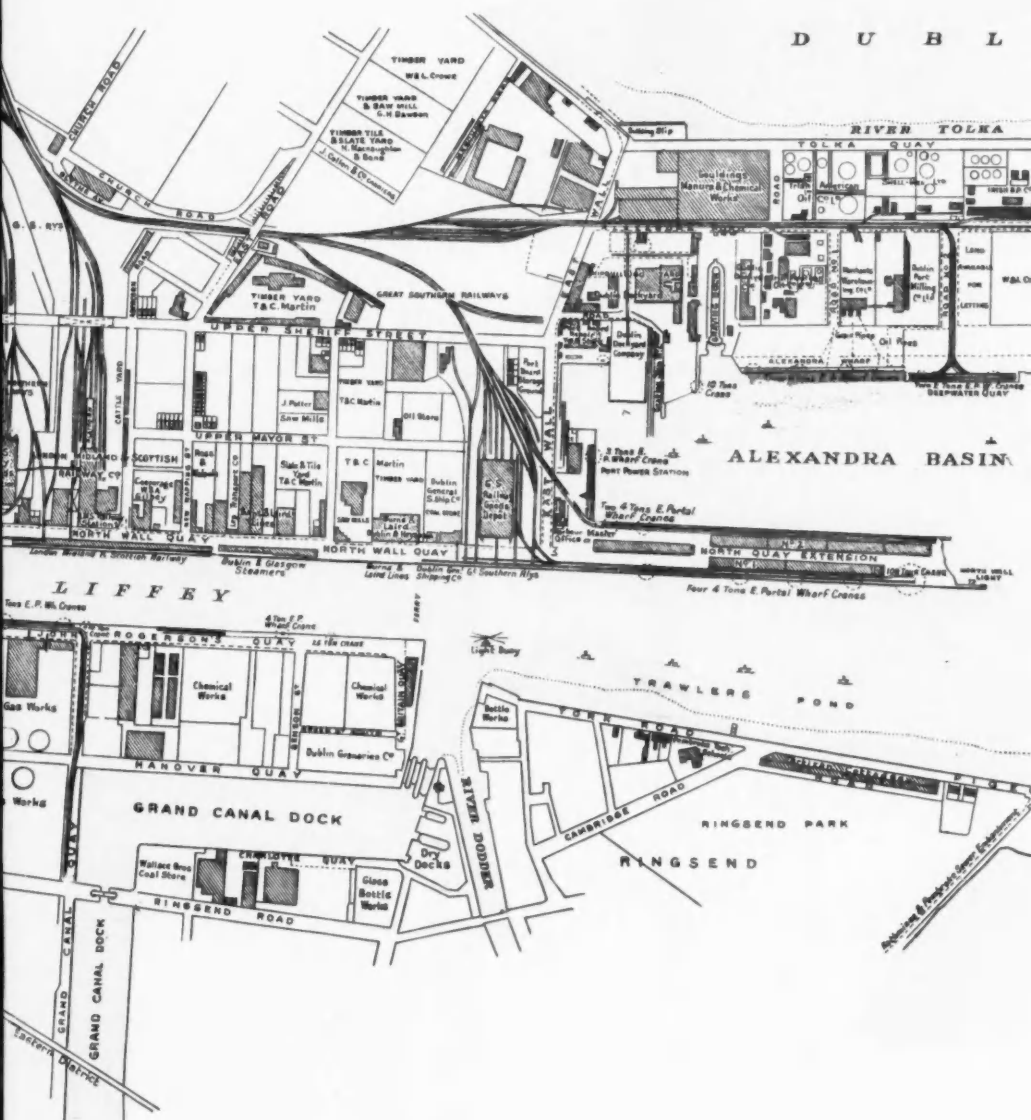


THE DOCK AND HARBOUR AUTHORITY.

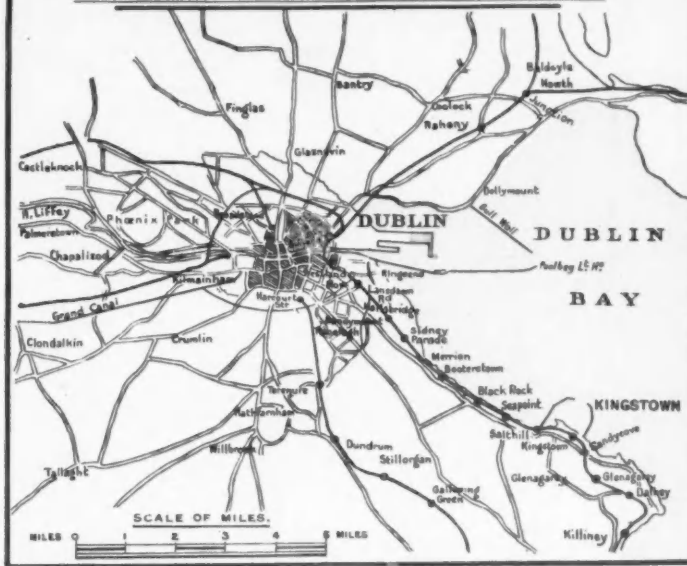
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BLIN PORT AND DOCKS BOARD.

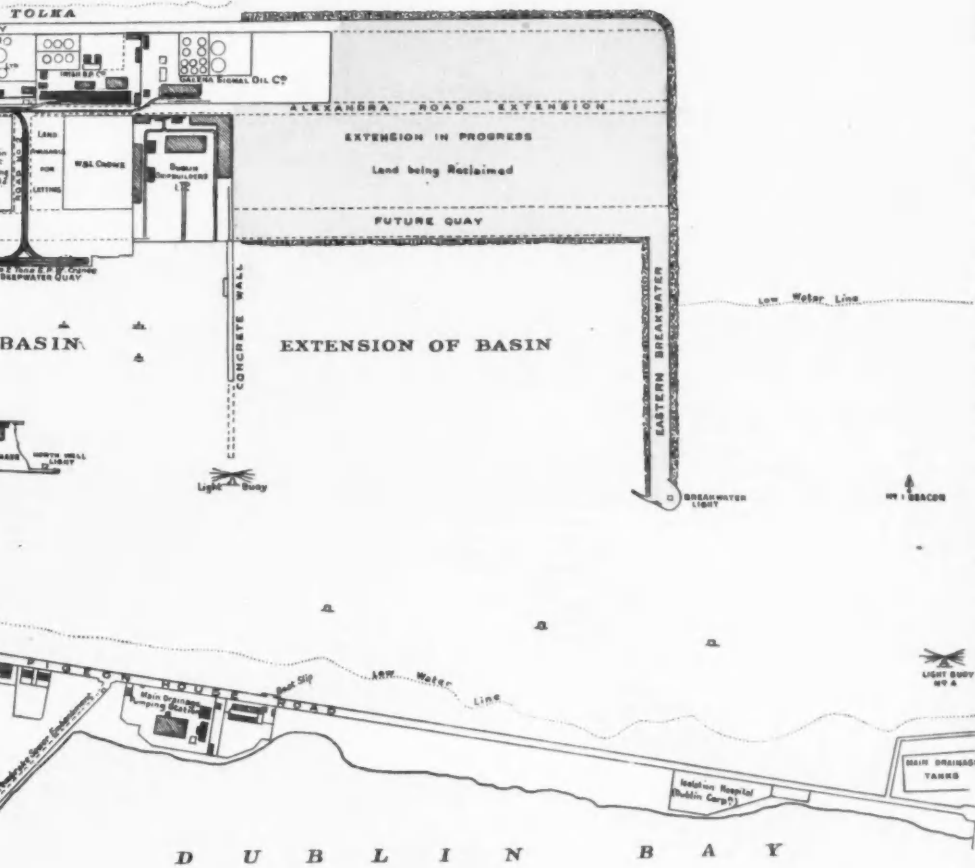
GRAVING SLIPS.					
SLIP	Extreme Length	Length of Cradle	Draught over Keel, Blcks at H.W.O.S.T.		Maximum Deadweight of Vessels.
			Forward	Aft	
Nº 1	350' 0"	76' 0"	5' 9"	9' 6"	200 Tons
Nº 2	537' 0"	135' 0"	7' 9"	18' 1"	900 Tons

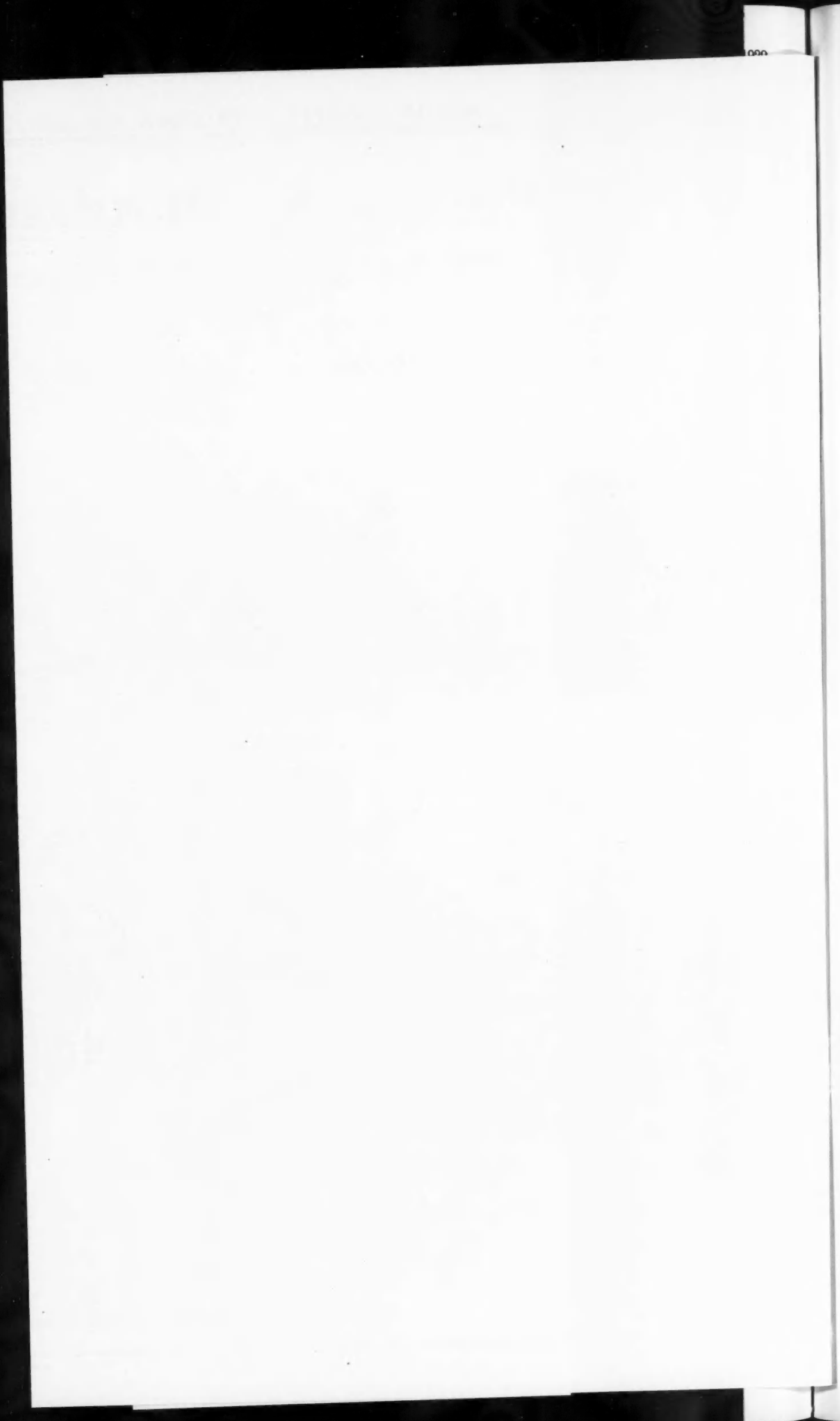


DUBLIN & ITS ENVIRONS.

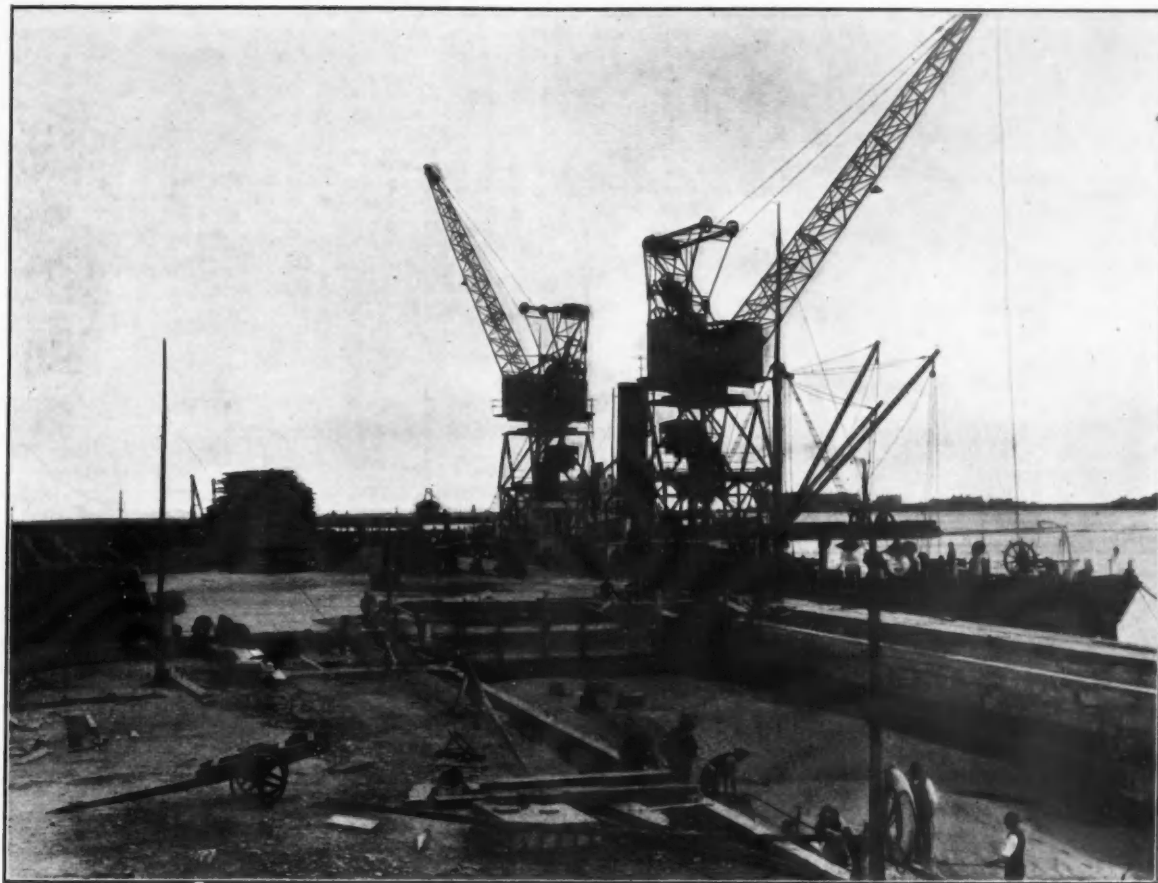


DUBLIN HARBOUR

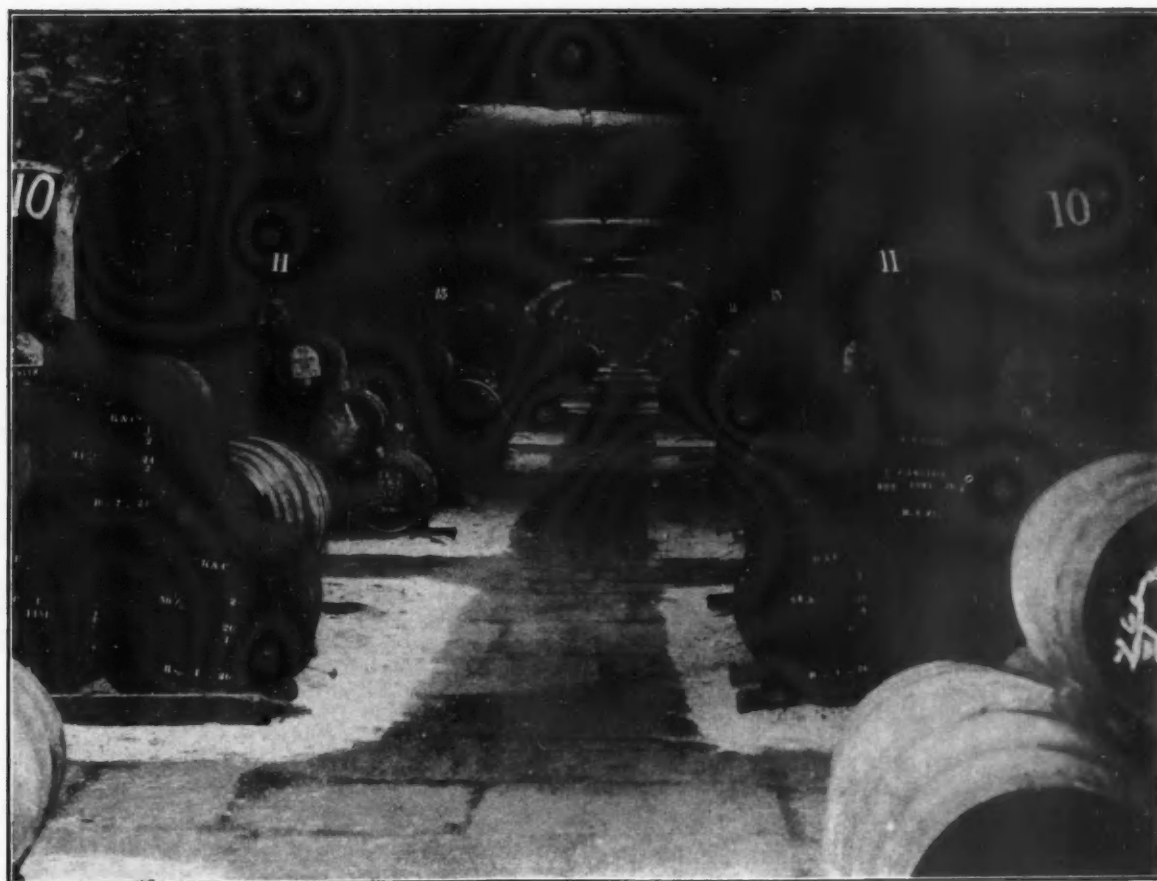




The Port of Dublin.



Port Extension at Alexandra Basin.



Dublin Custom House Docks' Bonded Warehouses. A vista in the Wine and Spirit Vaults.

BERTHAGE AND DOCKS.

The berthage allocated to shippers and unallocated is as follows:—

NORTH QUAYS.

	Length Feet	Depth below L.W.O.S.T. Feet
Custom House Quay, allocated	692	9-12
Custom House Quay, unallocated	649	8-12
North Wall Quay, allocated	3,755	16
North Wall Quay, unallocated	180	16
North Wall Extension, unallocated	4,104	16-26
Cross Berth	450	24
Alexandra Wharf	850	24
Alexandra Wharf	575	35

SOUTH QUAYS.

	Length Feet	Depth below L.W.O.S.T. Feet
George's Quay, allocated	260	16
George's Quay, unallocated	247	16
City Quay, allocated	700	16-20-22
City Quay, unallocated	611	20-22
Sir John Rogerson's Quay, allocated	1,300	19-22
Sir John Rogerson's Quay, unallocated	2,150	22
Great Britain Quay, unallocated	420	22
Inner Docks, allocated	1,833	13½
George's Dock, allocated	180	13½
George's Dock, unallocated	760	13½

Total berthage, 19,716-ft.; water frontage, 20,246-ft., or 3.83 miles. Canal Docks not included in above.

All the railways running into Dublin are connected with the North Wall Extension and Alexandra Wharf—only Grand Canal connection with South Quays.

Vessels of any length or beam and of draught up to 33-ft. can be accommodated.

NORTH QUAYS.

Name of Docks	Sill below datum feet	Water area acres	Lineage quayage feet	Depth of water At L.W.O.S.T. feet	Width of entrance at 2 hours after (gates open—shut) feet	Width of entrance at copied level feet
George's Dock	4½	1½	910	3½	13½	35½
Inner Dock	4½	4½	1,802	3½	13½	35½
Royal Canal Dock (affording inland water carriage)	2	1½	1,600	2	12	27
Spencer Dock (afford- ing inland water car- riage)	3	4	3,900	2	12	26

SOUTH QUAYS.

Name of Docks	Sill below datum feet	Water area acres	Lineage quayage feet	Depth of water At L.W.O.S.T. feet	Width of entrance at 2 hours after (gates open—shut) feet	Width of entrance at copied level feet
Grand Canal Dock (afford- ing inland water carriage)	5	24	5,300	5	18	35½

(Extent of waterfront, Grand Canal Dock, 5,300-ft.).

DEEP DRAUGHT VESSELS WHICH HAVE USED THE PORT.

	Draught ft. in.	Length feet	Breadth feet
m.v. "Borga"	25 0	362.4	51.4
s.s. "Comanche"	24 6	395.5	51.7
s.s. "Lord Londonderry"	23 8	427	53
s.s. "Jeff Davis"	28 2	395.5	55
m.v. "George Washington"	29 2	425.5	55.3
s.s. "Melmore Head"	26 0	390.4	51.8
s.s. "Callandia"	27 6	400.4	52.1

OWNERSHIP AND CAPACITY OF CRANES.

Load tons	Board's property	Privately owned
100	1 Electric	—
25	1 Hand	—
20	—	1 Hydraulic
10	1 Hand	—
5	1 Hand	—
4	12 Electric	—
4	1 Hand	—
4	—	4 Steam
3	5 Electric	—
3	2 Hand	—
3	—	15 Steam
3	—	6 Hydraulic
cwt.	—	—
35	—	1 Steam
35	—	2 Hydraulic
30	—	1 Steam
30	—	4 Hydraulic
25	—	2 Hydraulic
ton	—	—
1	1 Hand	—
1	—	1 Steam
1	—	1 Hydraulic

Total cranes in port, excluding Canal Docks, available for loading and discharging cargoes—62. The cranes at Grand Canal Docks are 12 in number, viz., ten 3-ton cranes at Hanover Quay, Grand Canal Quay, Charlotte Quay and Railway Bridge, and one 5-ton and one 2-ton cranes at Charlotte Quay. The Royal Canal and Spencer Docks (G.S. Railways) are furnished with two 3-ton gantry steam cranes, and there are four 3-ton hydraulic cranes on the Great Southern Railways' premises at North Wall Extension.

With the available cranes in the port working at maximum output, over 5,000 tons per hour can be unloaded. This figure does not include loads lifted by the 100-tons crane.

CUSTOM HOUSE DOCKS' WAREHOUSES, ALSO PORT SHED ACCOMMODATION.

Use of Warehouses.—The Board's warehouses are situated in the Custom House Docks. The services rendered include in the case of bagged or cased goods, housing, storing and piling, sampling, etc., and unhousing; in the case of wine and spirits in casks, housing, storing, piling, sampling, racking, blending and unhousing.

Storage capacity.—40,000 casks wines and spirits, 22,000 tons grain, 9,000 h'hds. tobacco, 10,000 tons general merchandise in addition to wharfage for 30,000 tons of coal.

North Quays—

Warehouses—To whom allocated.	Capacity in Cubic feet
Transit Shed, Custom House Quay	144,000
Shed, Custom House Quay (unallocated)	58,000
William Sloan and Co.	64,000
British and Irish Steam Packet Co.	623,000
London, Midland and Scottish Railway Co.	765,000
Burns and Laird Lines, Ltd.	306,000
Transit Sheds, North Quay Extension—	
No. 1 Shed	720,000
No. 2 Shed	996,000
Island Shed	426,000
South Quays—	
British and Irish Steam Packet Co., Ltd.	145,000
Transit Shed, Great Britain Quay	158,000

Total capacity ... 4,405,000

(Shed accommodation in Canal Docks not included in above table).

PROPRIETARY WAREHOUSE CAPACITIES.

In addition to the Dublin Port and Dock Boards extensive range of warehouses, there are proprietary warehouses with a capacity of 72,000 tons. This includes the 14,000 tons silo at Alexandra Wharf and cold storage accommodation.

There are four oil depots, with 32 tanks of 12,024,000 gallons capacity.

These proprietary warehouses and their capacities are detailed herewith.

MERCHANTS' WAREHOUSING CO.

	Tons
Silo, Alexandra Wharf	14,000
Sheriff Street	7,000
East Wall	17,000
Sir John Rogerson's Quay and Hanover Quay	15,000

DUBLIN GRANARIES CO.

	Tons
Sheriff Street	8,000
Hanover Quay	10,000

NATIONAL ICE AND COLD STORAGE CO.

	Tons
Sir John Rogerson's Quay	over 1,000

ACCOMMODATION FOR OIL CARGOES.

	No. of Tanks	Capacities. Tons	Gallons
Irish-American Oil Co., Ltd.	10	17,000	4,570,190
Shell-Mex (Ireland), Ltd.	4	6,253	1,918,910
Irish B.P. Co., Ltd.	6	5,305	1,485,500
Galena Signal Oil Co. (of Ireland), Ltd.	12	13,560	4,050,000
Totals	32	42,118	12,024,600

The Alexandra Wharf is connected with the various oil depots by privately owned pipe lines.

Sir John Rogerson's and Great Britain Quays are similarly connected with the premises of the Alliance and Dublin Consumers' Gas Co.

Alliance and Dublin Consumers' Gas Co. have a service of colliers between Dublin and various coal ports in Great Britain. Heiton and Co., ditto. J. Weatherill and Co., ditto.

Coal Wharves.—North Wall Extension; Alexandra Basin into railway wagons; Custom House Dock; allocated coal banks; Spencer Dock, Great Southern Railways; Ringsend Dock, Grand Canal Company.

Timber Wharves.—Alexandra Wharf; South Quay; North Wall Extension.

CROSS-CHANNEL, COASTWISE AND OVERSEAS SERVICES.

The following services trade between Dublin and the ports mentioned:—

British and Irish Steam Packet Co.—London, Liverpool, Manchester, Preston.

L.M. and S. Railway Co.—Holyhead.

Burns and Laird Lines, Ltd.—Greenock and Glasgow.

Dublin, Silloth and I.O.M. Co.—Silloth and Isle of Man.

Michael Murphy, Ltd.—Bristol Channel Ports.

Clyde Shipping Co., Ltd.—Waterford.

Bristol Steam Navigation Co.—Bristol.

OVERSEAS SERVICES.

Head Line.—Canadian, Baltic and Continental Ports.

United States Shipping Board.—United States Atlantic Ports.

Glen and Co.—Norway and Sweden.

Michael Murphy, Ltd.—Dunkirk, Havre and Boulogne.

Palgrave, Murphy, Ltd.—Continental Ports.

The Port of Dublin.



Dublin Custom House Docks' Warehouses. Duty Free Tea.



Dublin Custom House Docks' Warehouses. The New Tobacco Store.

Societe Anonyme Belgo-Irlandaise de Navigation.—Antwerp.
Bugsier, Rederei and Bergungs Aktien Gessellschaft.—Hamburg.

DUBLIN PORT AND DOCKS BOARD.

The Board now entrusted with this important public service was constituted by the Dublin Port and Docks Act, 1898, and consists of the Lord Mayor of Dublin for the time being, six members of, and appointed by, the Corporation of Dublin; 21 elective members—twelve traders and nine shippers. The Standing Committees are: Finance, Custom House Docks, Law and Parliamentary, Quay Police, Berthage, Through Rates, Works, Staff, Balbriggan and Skerries, and the Pilotage Committee established under the Dublin Pilotage Order, 1925.

The Board is the Harbour Authority of the Port of Dublin, which, as defined by the Dublin Port and Docks Act, 1869, extends from Barrack Bridges to the Harbour of Sutton on the north side, and to the Harbour of Dalkey on the south (excepting Harbour of Kingstown), and provides accommodation for all ships using the port.

Hull and the Humber.

At a meeting of the Humber Conservancy Board it was reported that the Air Ministry had provisionally marked out an area on the Humber as a Customs aerodrome for marine air craft. It was stated that the draft scheme provides for a portion of the water area in the vicinity of Hull being delimited. The area is defined as that part of the Humber bounded on the west by a line drawn true north from New Holland Pier and bounded on the east by a line drawn true north from Skitter Ness east beacon (approximately Saltend). All aircraft entering from abroad will be required to use this area. The Conservancy Board did not offer any observations on the proposal, but it is understood that nothing more is to be read into the scheme than that it is a preliminary proposal adopted in view of likely developments in air transport across the North Sea. As already reported, the Hull Corporation and other public bodies are moving actively to make Hull the airport for the North-East Coast with services to Copenhagen and Hamburg to link up with the numerous Continental services radiating from those cities. On the land side a direct service from Ireland to Liverpool, Manchester, Leeds, and thence to Hull is visualised.

With reference to the Grimsby Corporation's Dock Bill now before Parliament, it was stated at the meeting of the Humber Conservancy Board that the petition deposited against it was purely for the probation of the Board's interests. Mr. J. H. Fisher, J.P. (the chairman) remarked that it could possibly have been avoided if the officials of the Grimsby Corporation had arranged to meet the Board. Instead, they had not taken the trouble, and therefore the Conservancy Board were compelled to take action. The petition, he added, was a formal matter, and he was sure that their claims would be agreed to.

Mr. Councillor Rushforth (Grimsby) said that it was not intended to ignore the Conservancy Board, and explained that the Bill had been promoted in a hurry, and the rush of business had prevented a meeting being arranged.

The chairman: Well, we'll put it this way: that if the Grimsby Corporation had had time to look into our requests they would have granted them.

The Board was informed that further correspondence had been received from the Board of Trade with reference to the demand of the United Kingdom Pilots' Association for the abolition of the ballast rate. A local inquiry had been fixed to take place at Hull on March 5th, but it has since been postponed until a date to be named in April on representations from the Chamber of Shipping of the United Kingdom.

A report from the Engineer was transmitted to the Board, in which it was stated that the training wall in the River Trent had been commenced. The Board decided that part of the Hawke roads, within a radius of one mile from the No. 5 Upper Trinity Buoy, be appointed a place at which the ballast water of ships in which a cargo of petroleum spirit has been carried may be discharged, the discharge to take place only between half an hour after high water at Spurn and one and a half hours before low water. The North-Eastern Sea Fisheries Committee withdrew their objection to the proposal on the assurance that the regulations will be withdrawn should there be any ill-effects.

Congratulations have been showered upon Mr. Arthur Atkinson, president of the Hull Incorporated Chamber of Commerce and Shipping, on the honour of Knight Commander of the Order of the British Empire, conferred upon him in the King's New Year's list. Sir Arthur is a Hull shipowner, and has identified himself very closely with the philanthropic work of the city over a great number of years. He is an Honorary Brother of the Hull Trinity House. The only other honorary brethren being the King, the Prince of Wales, and Mr. T. R. Ferens, P.C.

One of the latest visitors to Hull to inspect the docks and the shipping facilities of the port is Sir James Parr, High Commissioner for New Zealand, who accepted an invitation to be the guest of the Chamber of Commerce, the Hull Cor-

poration, and the London and North-Eastern Railway Company on March 18th.

Public attention is again being directed to the proposal very dear to the hearts of West Riding people, for the construction of a ship canal from Goole to Leeds, which would enable ocean-going vessels, which at present cannot penetrate further inland via the Humber and the Ouse than Goole, to proceed to Leeds. The distance by the route of the existing waterway is 34 miles. Between Goole and Leeds there is a rise in the water level of 65-ft., which is overcome by a series of locks. There are no engineering difficulties in the way of the proposed ship canal; it is merely a question of public spirit and financial resources.

The extraordinary winter conditions prevailing in the Baltic during February and into March reacted upon the regular trade between Hull and Russia, Finland, Sweden and the independent Baltic States. Several vessels en voyage were held in the ice, while others fully laden were not allowed to leave port pending information that navigation was again open and that there was a reasonable chance of their reaching their destinations. On the other hand, the same conditions produced a largely increased demand for English coal for the Continent, and all the Humber ports experienced a period of exceptional activity, during which the export of coal rose to the highest levels recorded for some time past.

The Aire and Calder Navigation, based upon the port of Goole, is one of the most important inland waterways of the United Kingdom and has extensive ramifications in Yorkshire. At the annual meeting in March, Lord Deramore stated that the net revenue of the navigation in 1928 was £172,249, a slight decrease as compared with the previous year. The number of seagoing vessels using the Goole docks in the twelve months was 462, or six less than in 1927, although the number of visits paid to the port showed an increase of 34. Regarding general trade, the total carried by traders was 1,409,191 tons, being a decrease of 52,875 tons, chiefly due to smaller imports of grain, sugar, iron and steel. One of the most satisfactory features, Lord Deramore added, had been the large increase in the tonnage of fuel oil and petrol carried over the waterway.

The Trent Navigation Company, whose main system extends from the Humber to Nottingham, Newark, etc., also had a good year. During 1928, 104,032 tons of cargo were carried, an increase of 27,551 tons over the previous year. The traffic revenue amounted to £64,592, an increase of £5,683, and the expenditure to £62,630, an increase of £4,786. The general accounts show total receipts £71,945, compared with £66,370, and expenditure £71,522 against £65,801. In the expenditure is included the sum of £3,242 paid to the Nottingham Corporation, being tolls on their portion of the navigation. During the year the company opened depots at Gainsborough and Gunthorpe, and as a result secured new traffic.

Shipping at Constantinople in 1928.

The number of vessels operating in or passing through the port of Constantinople showed a marked decline in 1928 as compared to preceding years. The total tonnage of these vessels, on the other hand, was comparatively stable.

The following table shows the number and tonnage of vessels operating in, or passing through, the port of Constantinople in 1926, 1927 and 1928.

Year	No. of Steamers	Total Tonnage
1926	8,621	13,040,894
1927	8,247	12,726,061
1928	6,976	12,261,534

The decline in the number of vessels is due principally to the fact that many of the small Turkish and Greek coasting steamers have been driven out of business by the competition of larger, more reliable, and better equipped vessels.

The principal nationalities represented were:—

Flag	No. 1926	Tonnage 1926	No. 1927	Tonnage 1927	No. 1928	Tonnage 1928
Turkish	2,712	1,264,236	2,882	1,404,407	1,348	1,255,957
Italian	1,198	2,406,656	1,150	2,551,911	1,034	2,213,586
British	1,073	2,470,036	978	2,075,018	848	1,915,053
French	339	777,551	322	830,361	327	876,010
Greek	1,567	2,121,348	1,236	1,578,421	674	778,950
Norwegian	133	338,539	129	335,522	237	687,854
German	268	453,987	299	514,243	319	576,673
Soviet	153	206,232	168	303,622	275	468,891
Roumanian	428	576,572	315	448,226	303	468,183
U.S.A.	52	138,686	87	177,461	89	203,110

Excluding Turkish shipping, 15 per cent. of the vessels passing through this port in 1928 were under the British flag, as against 15.5 per cent. in 1927 and 18 per cent. in 1926, whilst on the basis of tonnage, British vessels represented 17.4 per cent. as against 18.5 per cent. in 1927.

The following statistics show the number of vessels operating in the port and the number passing through in transit.

	Operated	In Transit	Total
Turkish vessels	1,178	170	1,348
British vessels	302	546	848
Other vessels	1,568	3,212	4,780
Total	3,048	3,928	6,976

Notes from the North.

SHIP CANAL CO.'S HINT TO SHIPOWNERS.

Complaints against steamship owners discharging cargoes at Manchester Docks and loading up elsewhere, were made at the annual meeting of the Manchester Ship Canal Co., Ltd., when Captain W. C. Bacon, chairman of the directors, mentioned that the Company had spent a large sum of money deepening the Ship Canal to 30-ft. of salt water up to the Oil Dock at Stanlow, about half a mile from Ellesmere Port. This facility had been designed to allow, amongst other things, Conference steamers an opportunity of loading outwards from the Port of Manchester as their last port of call. The coal bunkering appliances at Ellesmere Port were of a unique character. Electrically-driven cranes could swiftly load cargo into Conference steamers if they called there to finish for sea, after having loaded the bulk of their cargo at the Manchester Docks. Now that these facilities are completed and in operation, he hoped that some of the Conference lines, at least, would make a trial of loading outwards from Manchester. The saving in carriage of several shillings per ton could be effected on piece goods and fine goods if vessels would use this port instead of going away light to load elsewhere after having discharged at Manchester. At Ellesmere Port, $3\frac{1}{2}$ miles inward from Eastham Locks, the Company had provided cargo handling and bunkering arrangements, which had created an entirely new situation, soon, it is hoped, to be fully exploited. Before the deepening of the lower section, it was the practice for some of the larger vessels sailing from Manchester to complete their cargoes at another port. The new conditions enabled ships to load down to 28-ft., or 28-ft. 6-in., which meant a considerable increase of cargo, and thus complete their loading within the confines of one port. This would be at once a convenience to exporters and a saving of time and money to shipowners who would secure better despatch and have but one set of port charges to meet. The exporters of fine goods to India, Australia, South America, the Far East, and elsewhere who desired to ship them at the last moment before the vessel proceeds to sea, might, if necessary, forward them by rail or road to Ellesmere Port at no greater cost than to Liverpool or Birkenhead. Dredging last year cost £143,357 for 3,178,511 yards. The previous year they took out 2,910,621 yards, and it cost them £140,701. When the canal was made they did not expect so much dredging.

DEVELOPMENT OF MANX HARBOURS.

Mr. W. H. Blaker, A.M.I.C.E., gave some interesting details of the development of Manx harbours in an address before the Douglas Rotary Club. Mr. Blaker said that the chief harbour in the Island from 1405 up to the 17th century was the one at Derbyhaven, and the trade appeared to be mainly between there and Whitehaven. That great importance was attached to Derbyhaven was shown by the fact of a fort being built there, whilst another evidence was the out-post building at Hango Hill, between Derbyhaven and Castletown. The view was expressed that Derbyhaven was the best natural harbour in the Isle of Man. There was always a race in the natural order of things between ships and harbours. Ships got bigger and harbours had to be increased in size and depth. Liverpool, he suggested, had done much to develop Douglas. Mr. Blaker traced the building of the Tongue, followed by the Red Pier, which subsequently replaced an older pier. Later the Fort Anne Jetty was built which, he declared, was the most beautiful piece of work there was in the Island, not an ounce of mortar being used in its construction. The Victoria Pier was built in 1870 and the Battery Pier was made about the same time. The Loch Promenade was constructed in 1878, and Victoria Buildings in 1886, and about that time 400-ft. was added to the Victoria Pier, the work being finished in 1891. The Swing Bridge was built in 1896, and in 1913 the Victoria Pier was widened. In 1923 considerable dredging took place and the shelter was built on the south side of the pier in the following year.

It was essential that they should have more berths at Douglas, there being only four berths available to deal with the heavy season traffic. Progress had, perhaps, been rather slow, but there was evidence that the harbours have moved with the times. Reference was then made to the development of other harbours, indicating that from 1890 to 1891 there was a great boom in works construction. The north breakwater at Ramsey was constructed in 1870 and the south breakwater was also extended. In 1885 the Queen's Pier was built and this was extended in 1897. The Port St. Mary breakwater was built in 1883, and the Raglan Pier, Port Erin, in 1915. Considerable construction work was also done at Peel, Laxey, and Castletown, including the swing bridge at the last-named place.

PRESTON DOCK RETURNS.

Extensions in the cattle lairage at Preston Dock, at a cost of £2,600, have been recommended by the Ribble Committee of the Preston Town Council. Trade returns for the month of January at the docks compared with the previous year, show an increase in revenue of £3,683, the figure jumping from £16,017

to £19,700. Imports amounted to 50,467 tons, compared with 42,039, and exports to 12,182 compared with 12,737. The number of animals landed was 5,771 against 3,845 in the previous January. There is every hope of a revival in the shipment from Spain of the firestone commodity known as pyrites. A 1,300 ton cargo of pyrites arrived at the beginning of February from Seville for chemical firms in East Lancashire. At one time a considerable trade was done in this commodity. The first cargo from Cuba in connection with the asphalt and bitumen undertaking which has leased a considerable amount of land at the Preston Dock for the erection of plant, was expected towards the end of last month (March). This new business is also certain to provide a big stimulant.

ANCIENT MERSEY LANDINGS.

Captain W. H. Fry, General Manager of the Wallasey Corporation Ferries, in a lecture to the local branch of the National Association of Local Government Officers, mentioned that a ferry or passage existed across the Mersey, and apparently had financial value, as early as 1515. At the end of the 18th century there were no fewer than seven different ferries competing. Captain Fry dealt with the difficulties which must have existed in the absence of proper landings, and the undoubted fact that the moods and tidal streams of the Mersey were similar to those existing to-day. After illustrating by slides the appearance of the earliest landings, the lecturer showed and explained pictures of the ancient wooden pier at New Brighton, which was used in the early part of the 19th century, and also the old pier at Seacombe, used until 1878. He paid a well-deserved tribute to the great courage and foresight of those responsible for the Seacombe improvements in 1878, and commented on the great cost of that undertaking. Some slides showing how even this big work fell into decay were shown, and then a series dealing with the work of installing the new works in 1924. Dealing with the Ferries Department's business, and its phenomenal growth, some figures were thrown on the screen from which it appeared that the number of vehicles transported had risen from 1,000 per annum in 1880 to 360,000 in 1928.

MERSEY TUNNEL PROGRESS.

Good progress is being made with the new Mersey Tunnel shaft, which is being sunk at Sidney Street by Sir Robert McAlpine and Sons, to whom has been entrusted Contract No. 3 for the construction of the entrance tunnels on the Birkenhead side. The construction of the main under-river 14-ft. diameter tunnel, lined with cast iron segments, is being carried out by Messrs. Edmund Nuttall Sons and Co., Ltd., of Manchester, while the borings towards the respective entrances at Market Place South and Rendall Street will be effected simultaneously by the new contractors. The contract for the approach borings on the Liverpool side will be let at an early date. In the early part of March the drillers excavated the new shaft at Sidney Street to a depth of about 20-ft. The shaft, which is similar to that sunk at the Morpeth Branch Dock, was started without formal ceremony about a fortnight previously, and powerful drills, wielded by some 15 men, have quickly eaten away the red sandstone rock.

TESTING A FLOATING CRANE.

Tests were carried out on the great floating crane, capable of lifting over 150 tons, which has been erected on its pontoon in the Prince of Wales Dock, Workington, by Messrs. Cowan & Sheldon, engineers, of Carlisle, who have built it for the French authorities at Suez. One of the tests was to lift a large boiler out of one of the hoppers in the dock.

DOCK BOARD STAFF COMPLIMENTED.

The Chairman of the Birkenhead Corporation Ferries Committee, Mr. E. J. Hughes, at the March meeting of the Town Council, paid a compliment to the officials and staff of the Mersey Docks and Harbour Board on the expeditious manner in which they had executed the work of reconstructing the floating roadway at Woodside. The work was finished in three weeks, when the estimated time was five.

PRESTON—A PETROL PORT.

During the last five years there has been a wonderful growth in the petrol traffic of the port of Preston. Mr. J. G. Merriweather, the General Traffic Manager and Superintendent of the dock, in the annual report of the Preston and District Chamber of Commerce, states that the motor spirit traffic continues to increase, this year's import of 93,599 tons being 15,633 tons more than last year.

The growth of this traffic is illustrated by the fact that in 1923, when motor spirit began to arrive at the port in appreciable quantities, the imports totalled 3,661 tons—less than 4 per cent. of the total to-day, which represents approximately 28,000,000 gallons. It is pointed out that firms have recognised the geographical advantage of Preston and its suitability as a cheap centre of distribution. In common with other ports, Preston has been affected by the general depression in trade, which has resulted in a falling off in imports compared with last year. The depression in the paper, cotton and building

trades has affected the import of wood pulp, china clay and timber, while local authorities are not purchasing so much stone as formerly, probably on the grounds of economy. An appeal is made to Preston traders to make a greater use of the dock, the traffic from Belfast to Dublin being mentioned as services likely to be of great advantage to them.

DE-RATING BENEFITS.

Mersey Docks and Harbour Board, on March 7th, approved of the following minute of the Finance Committee:—"The Committee, having at this and previous meetings considered how best to utilise for the advantage of the trade of the port, the relief from rates which the Board will obtain from the Government de-rating proposals, and being of opinion that some immediate relief should be allowed to the coasting trade, have resolved to recommend as from the 1st April, 1929, inclusive, and during the pleasure of the Board, that outward coastwise town dues be not charged on any goods exported coastwise, subject to the approval of the Ministry of Transport." The Chairman of the Committee stated that the reduction had been made possible by anticipating a proportion of the saving in local rates on the dock estate which, as from the 1st October next, would be brought about by the de-rating scheme in the Local Government Bill now before Parliament. In view of the Government having ante-dated the concession granted under the de-rating scheme to certain traffics carried by rail as from the 1st December last, the Committee thought they were justified in making this recommendation which, if adopted, would benefit not only every shipper of goods coastwise from Liverpool, but also assist the coastal shipping services by an increased flow of trade. The Committee felt that a concession which made Liverpool a free port for all goods leaving coastwise would not only be of great value to manufacturers and traders, but would also act as a real stimulus to the coastal trade generally.

FIRST FLEETWOOD CONTRACT PLACED.

Work will be begun almost immediately upon the construction of the extensive additions and improvements to the Wyre Dock fish stages and market, upon which the directors of the L.M.S. Railway Company some time ago decided to spend over £100,000. The project is to be carried out in two sections. The contract for the first portion representing about one-half of the complete scheme, has been let to Messrs. Thos. Wrigley, Limited, Manchester, who have carried out many large undertakings. Messrs. Wrigley's contract includes the widening of what is known as the "herring arm" of the fish market, over which will be built an extensive "loft," for the storage of boxes required by merchants for the transport of fish, and the construction of a special passenger berth for the expeditious handling of consignments of fish by passenger train. The widening of the remainder of the market, the erection of a "Merchants' Galley," and other improvements will, it is expected, follow in due course. The market, which is 2,000-ft. in length, is to be widened from 70-ft. to 100-ft., additional berthing accommodation will be provided for trawlers, and in various ways the L.M.S. directors are showing their will to develop the Wyre Port. Improvements will also be effected to the dock itself, the entrance being widened by 50-ft., to allow the biggest trawlers being easily manoeuvred. The details of the scheme were agreed at joint conferences between the railway authorities, trawler owners and fish merchants.

NEW RIVER WALL.

At Preston a Ministry of Health inquiry was held on March 13th, concerning the proposal of the Corporation to borrow £10,000 for the erection of a concrete wall along Broadgate and an earth embankment below Penwortham new bridge to protect the Broadgate area from flooding. It was explained that the works proposed consisted of an earthen embankment with a puddle core upon the walk alongside the river Ribble on the south-west of Broadgate. A reinforced concrete parapet wall 3-ft. 9-in. high would be constructed on the embankment, securely founded upon reinforced concrete piles, driven into the bank of the river. That construction would extend from the Penwortham new bridge up stream as far as the West Lancashire Railway Viaduct. The area would be protected by embankments and walls at the up-stream end joining up to the river embankment. At the down-stream end it was proposed to construct a low embankment with a puddle core on the dock lands from Penwortham new bridge to the east end of the new diversion sea wall. This embankment would prevent the flooding and influx of water along Strand Road and Fishergate Hill. Mr. J. Barron (Ribble Engineer) said that the flood of October 29th, 1927, rose to 23.76-ft. above datum at the dock gate, and 23.85-ft. a mile below. Ordinary spring tides were about 14.63-ft. at the dock rising to 17.63-ft., but on this special occasion it rose to 23.76-ft. This was not flooding in the ordinary sense of the word. The water was backed up by a gale from the sea. It was a devastating flood and did great damage.

CUT IN PILOTAGE RATES.

At their meeting on March 14th, the Mersey Docks and Harbour Board considered the decisions of the Board of Trade

as to reduced pilotage rates. The Board decided:—(1) That the rates for inward and outward compulsory pilotage set out in paragraphs 1 and 2 of Part 1 of the Schedule to the Bye-laws relating to pilotage, be reduced by 15 per cent; (2) that the rates for pilotage to or from Garston or Eastham be reduced by 15 per cent; (3) that the existing concession of half rates to coasting vessels provided for be extended to the additional payment for coasting vessels proceeding to or from Garston or Eastham; (4) that the charge of £3 3s. for late booking be reduced to £1 1s. The new bye-law will come into operation on April 2nd.

The Board accepted the following tenders:—Demolition of shed, etc., east side, Prince's Dock—J. Routledge; steel reinforcements, East Quay, Prince's Dock—British Reinforced Concrete Engineering Co., Ltd.; and coal for pilot boats—James Chambers & Co.

MANCHESTER SHIP CANAL CO. HIGHER STAFF CHANGES.

The Manchester Ship Canal Co. announces that Mr. Ernest Latimer has retired from the position of Managing Director of the Company, but retains his seat on the Board of Directors. Mr. F. A. Eyre, Secretary and Accountant of the Company, has been appointed General Manager. Mr. Matthew Kissane, Assistant Secretary, has been appointed Secretary. Mr. H. O. Whitelegg, Assistant Accountant, has been appointed Accountant.

Mr. Herbert Mends Gibson retains his position as Chief Superintendent and will, as heretofore, control the commercial section, including development of traffic and tolls rates and charges. Mr. William Browning retains his position as Traffic Superintendent in charge of the administrative work of the Ship Canal and Docks.

Tyne Improvement Commission.

Description of Steel Pear-shaped Patent Spindle-type Mooring Buoy.

The Tyne Improvement Commission have between 400 and 500 mooring buoys in use on the River Tyne. These buoys are made in their entirety at their Yard at Howdon, the only finished material purchased outside being the top and bottom steel castings.

The illustration shows a No. 1 size buoy as now being made. It is 9-ft. 2-in. long by 8-ft. 6-in. maximum diameter, and is constructed of ten uniformly shaped 5/16-in. mild steel plates in each lower and upper portion, meeting in a circumferential seam around the major diameter, the extremities of the plates being finished off with crown plates at the top and bottom of the buoy.

The plates are ordered the exact size required for working, being heated in a furnace and dished in moulds ready for punching and riveting.

The centre tube of the buoy consists of a steel plate rolled and electrically welded at the butt, finished at the top and bottom with seamless flanged pressed steel plates, also electrically welded to the tube, the horizontal flanges of these plates being riveted to the top and bottom crown plates.

The ends of the buoy are fitted with cast steel chafing plates, the top casting being welded to the crown plate and the lower one riveted.

A forged iron spindle 4½-in. diameter is fitted through the tube, having a circular eye at the top to take ships' moorings, and an elongated eye at the bottom for shackling to the buoy chain of the river moorings. This spindle, which has been patented, is forged in one piece from heavy scrap iron, and holds the buoy, which is simply a float in position, by means of the shackle at the lower end of the spindle and the ring at the top. The eye at the head of the buoy when not in use is always in the upright position convenient for attachment of ships' cables and ropes, and, being fixed, prevents any damage to the buoy otherwise caused by contact of loose rings or shackles.

The steel plates and rivets used in the construction of the buoys must conform with the British Standard Specification for steel for shipbuilding, and the spindle with Grade A British Standard Specification for wrought iron.

The spindle, being a separate part of the mooring, is tested before fitting into the buoy, which ensures uniformity in the strength of the mooring being maintained from the river bed to the vessels' cables, and when buoys are damaged the spindles can be removed and used elsewhere, if necessary.

The buoys when completed are tested to a hydraulic pressure of 10 lbs. per square inch, and the spindles to a proof stress of 176.4 tons.

The buoys when floating at the maximum diameter are capable of supporting a weight of approximately 4½ tons.

When buoys are damaged by blows from vessels, or other cause, they can be quickly and conveniently removed by releasing the shackle between the spindle and the top of the buoy chain, and the simplified construction of the buoy, free from single plates of large area, wood chocks and other fittings, admits of repairs being done cheaply.

Turbo-Electric Liners.

Considerable interest is being shown these days in the various alternative methods of driving locomotives and propelling ships; and the results achieved by the new P. and O. liner "Viceroy of India" are being awaited throughout the world, one might almost say, by marine engineers. This vessel, which has been built by Alexander Stephen and Sons, of Linthouse, is the first large passenger liner to be fitted with high pressure steam and turbo-electric propulsion. She has a tonnage of 19,700, a speed of 19 knots, and her machinery is rated at 17,000 s.h.p.; she will carry 415 first-class passengers in separate cabins, 260 second-class and a crew of 420.

The propelling machinery consists of two separate turbo-alternators which supply current to two slow-speed synchronous motors, which in turn are direct coupled to the twin propeller shafts. When reduced power only is required one turbo-alternator is used, the second being a standby, and can be brought into service in the event of lost time being required to be made up. Such an arrangement obviously leads to great fuel economy.

The propeller speed can be varied in either direction by controlling the turbine speed, and this feature is always under the control of an engineer. The direction of rotation of the propeller is changed by reversing the connections of two of the three phases leading from the alternators to the motors, this being accomplished by means of contactors which are operated by levers located on the control platform. The turbo-alternators always turn in the same direction, and, with both in operation, the speed and direction of either propeller can be varied independently of the other. When one turbo-alternator is employed for driving both propulsion motors, both motors run at the same speed, though they can rotate in the same or in opposite directions.

Steam is raised in six Yarrow boilers which are fired on the Clyde oil fuel system. Four boilers are placed in the aft stokehold and are of sufficient capacity to enable the forward stokehold to be entirely closed down when the vessel is travelling at 16½ knots. There are, in addition, two cylindrical boilers in the forward stokehold which supply steam in port. Steam is supplied to the turbines at 350-lb. per sq. in. gauge and 700 deg. F. total temperature.

When starting or reversing, the turbo-alternators run at about one-fifth speed or below, and the propulsion motors are brought up to a corresponding speed as induction motors. The field windings of the alternators are temporarily over-excited during the reversing and accelerating period to bring the propulsion motors up to speed, and then to bring them almost into synchronism. The motor fields are then excited to bring the motors fully into synchronism, and finally the alternator field strength is reduced to normal. A separate motor-driven exciter set supplies excitation to each turbo-alternator, and change-over links enable the exciters to be interchanged if required.

All the services on board ship are electrically operated, all cooking, heating, ventilating, lighting and the auxiliary machinery being motor-driven, and to supply this large demand for current, four auxiliary turbo-generators, each developing 500 kw., as well as two solid injection oil engine-driven generators, each of 165 kw., are installed.

The main switchboard is at the aft end of the engine room, and within view of the main starting platform, which is located between the two turbo-alternators and above the main propelling motors. Also at the aft end of the engine room, on the port side, is situated the engineers' workshop equipped with lathes, drilling and grinding machines, all driven by independent electric motors. Eleven large ventilators are fitted in the engine and boiler rooms.

The main propelling equipment may be classified in three sections: (1) Two turbo-alternator sets, maximum rated 9,000-kw., 2,690 r.p.m., 2,720 volts, three-phase. The maximum speed rating is 636 kw., 3,110 r.p.m., 3,150 volts, three-phase. (2) Two synchronous propulsion motors, each 8,500 s.h.p., 109 r.p.m., 3,150 volts, three-phase. (3) One control apparatus group, and also the necessary exciter sets and ventilating fans.

At the forward end of the control cubicle are the isolators and tie switch, each being triple pole, and operated by hand-wheels. The isolators enable each alternator to be electrically connected to its respective propeller motor, or either of the alternators to be connected to both propeller motors.

The controls are interlocked so that damage cannot be done to any part of the equipment when manoeuvring by an unskilled operator. Indicating instruments are also provided by means of which an intelligent operator can carry out orders in a very short space of time with the minimum effort.

For each propeller there are three controlling levers for operating the contactors and speed settings of the governor. These levers are: (a) direction lever; (b) field and speed controlling lever; (c) dead slow speed lever. These are all mechanically interlocked to ensure correct operation. Thus, the direction lever (a) can only be moved if the manoeuvring lever is at "stop." The field lever (b) in its first half of travel operates the field contactors in the correct sequence for starting the motor. For the remaining half-travel, the control is on

the governor of the turbine, the speed setting of which it varies between one-fifth and full speed. A micrometer adjustment is also provided on this lever which permits fine speed settings. Since the same lever is used for both purposes, all manoeuvring must take place with the governor setting at one-fifth speed. This lever is interlocked with the slow-speed lever (c), so that the latter cannot be used for reducing speed below one-fifth unless (b) is in its slowest speed position, and correspondingly lever (c) must be at its maximum speed position before the speed can be increased with lever (b).

The whole of the control cubicle is "mistake-proof," and, with the special keys, incorrect switching is impossible; for example, whenever it is necessary to open or close an isolator or tie switch it is essential to have all contactors in the open position. A special lock is therefore fitted to the levers, the key of which is also used to free the isolators; the reversing and field levers must be "off" and locked in this position to release the key.

An electrical interlock prevents the circuit breaker on the main d.c. switchboard from closing unless the field levers are both in the stop position. This prevents the fields being switched on to the machines after a shut-down on the d.c. side, without bringing the field levers to the "stop" position and starting up again in the usual way.

Boiler Plants in Docks and Harbours.

Simple Methods of Improving the Efficiency.

By far the largest proportion of the coal burnt in the world for steam generation is consumed by the smaller and medium-sized industrial boiler plant, such as in docks and harbours, and in railway depots, for example, having, say, one to four standard 30-ft. by 8-ft. "Lancashire" boilers, or other types such as "Vertical," "Cornish," "Marine," "Economic," and "Locomotive" designs. Almost invariably in the operation of steam generation plants of this character a saving can be obtained, and the recent great developments in power practice do not only apply to the large industrial and power station plant.

Some of the obvious methods of economy for the smaller boiler plant are ample flue area, as well as tight brickwork to prevent air leakage, easily tested by means of a lighted taper or lamp, and in this connection a valuable material for patching holes and cracks is a mixture of equal parts of pitch and cement heated up.

With regard to the prevention of scale and corrosion, if a water softening plant is not installed, in many cases quite excellent results can be obtained merely by adding to the boiler feed water with every stroke of the pump a small amount of sodium bicarbonate, a cheap material, say, 1—1½-lbs. per 1,000 gallons of water evaporated. Also a complete cure can be effected by using tribasic phosphate of soda, whole of the calcium and magnesium salts being precipitated as soluble phosphates, although this is apt to be a little expensive.

Further, every effort should be made to utilise all the exhaust steam available for heating the feed water, and, of course, for a medium-sized plant an efficient installation of feed water economiser is essential, since every 11 deg. F. rise in the water saves about 1 per cent. of the coal bill, and the temperature going into the boilers ought to be raised to 240—300 deg. F.

Again, it is essential that the boiler and the steam pipes should be covered with efficient non-conductive material such as 85 per cent. magnesia, slag wool, asbestos or high-grade diatomite composition, particularly including the flanges of the steam pipes and the boiler fronts down to the firing level.

Finally, a very important point is efficient draught so as to consume the fuel without undue excess of air at a high temperature with the maximum emission of radiant heat. In this connection, the "Turbine" forced draught steam jet furnace is invaluable, since it can be applied to any boiler in the simplest manner simply by taking out the existing firebars and replacing them by the furnace, which is also made to suit grate spaces of any size and shape.

The amount of steam consumed by the nozzles does not exceed about 3 per cent., which is, in practice, little more than mechanical forced draught, and without, of course, all the complications of the latter, which in any case is not a practical proposition for the small boiler plant. Also, the furnace operates with hand firing as usual, and any amount of draught can be put on instantly merely by adjusting a steam valve.

Further, a furnace of this character will burn any quality of fuel, from the highest grade coal and coke down to material impossible with natural draught, and even extremely difficult with ordinary mechanical draught. Some examples are coke breeze and dust, small coal from the mines, and general refuse, such as sawdust, shavings, and small pieces of wood, while a valuable source of economy, as well as of black smoke prevention, the blending of coal with such low grade fuels.

North-East Coast Notes.

RIVERSIDE QUAY, ALBERT EDWARD DOCK ON THE TYNE.

The Riverside Quay, at the Albert Edward Dock, on the Tyne, which is shown in the accompanying photograph, is one of the most recent developments of the River Tyne Improvement Commission. It is most conveniently situated, being only two miles from the mouth of the river. The quay is 1,100-ft. long and is equipped with the most modern appliances for securing rapid turn-round of vessels. It has a single-storey hoist 500-ft. long, and Customs offices and railway platform. Provision has been made for an ultimate depth at the quay of 30-ft. at low water ordinary spring tides. There is a hydraulic lift on the quay capable of lifting (loaded) 20-ton coal wagons, and delivering into ships at a height of 65-ft. above high water ordinary spring tides, at a speed of 500 tons



The Commissioners' New Riverside Quay, Albert Edward Dock.

per hour. The Norwegian mail steamer traffic, which until recently was accommodated at the Corporation Quayside at Newcastle, has been transferred to the Riverside Quay, and the London and North-Eastern Railway Company have made special arrangements to deal expeditiously with the passenger traffic, a special boat train running from King's Cross Station, London, through Newcastle, on to the landing platform. The quay was only opened in June last, and has been increasingly well patronised.

PERSONALIA.

Mr. Frederick L. Dawson has been elected chairman of the North of England Steamship Owners' Association, and Mr. F. Carrick vice-chairman. Mr. Dawson is well-known in shipping circles on Tyneside, being head of the firm of F. L. Dawson and Co. and connected with the Seed Shipping Co., Ltd., and Crete Shipping Co. Mr. Carrick, who was originally with Wallsend and Hebburn Coal Co., established the firm of F. Carrick and Co., which, in 1922, was converted into a limited liability company. Mr. Carrick is also connected with the Pelton Steamship Co.

Mr. W. A. Souter, head of the Sheaf Steamship Co., has been presented with a piece of silver by his quayside friends to mark the fiftieth anniversary of his birthday.

Mr. John R. Wilkinson, who has been fifty years in the service of South Hetton Coal Co., has been presented with the Commemorative Parchment of the Newcastle Commercial Exchange in recognition of his connection of over half a century.

Teeside lost a personality well-known in local industrial and commercial circles by the death of Mr. Iltyd Williams, who for many years had had control of the Linthorpe Ironworks and was chairman when it was amalgamated with the Dinsdale Iron Co. He was at one time a director of Messrs. Bolckow Vaughan and Co.

DELAYS TO SHIPPING.

The question of delays to shipping because of shortage of coal cargoes again cropped up in the middle and later part of February, but all through the country there was really little cause for complaint, and in almost all cases there was only one explanation: that was the sale of particular brands of coal to a point which temporarily exceeded the output. The extreme frost during the latter half of February checked shipments to the extent that operations were rendered slower, but that was the only handicap, and at the Tyne the shipments generally are exceeding those of the last year by about 30,000 or 40,000 tons per week. The total coal and coke shipments from the Tyne during January were 1,563,903 tons, an increase on last year of 249,652, equal to nearly 19 per cent. The London and North-Eastern Railway reported that the coal and coke shipments at their ports on the North-East Coast during January showed an increase of over 280,000 tons compared with the corresponding month last year. At Blyth there had been an increase of

over 35,000 tons, at Tyne Dock 180,000 tons, at the Hartlepoons 57,000 tons, and at Hull 24,000 tons.

These figures demonstrate how the great basic trade of the area has improved, and this increase in activity has brought more work for all the collateral industries.

Figures issued by the Board of Trade regarding the coasting trade show that vessels arriving at Tyne ports with cargoes exceeded by 25,000 tons those of January, 1928, equal to 21 per cent. increase, and tonnage arriving in ballast was 62,000 tons more, or 16 per cent. above the same period last year. The sailings of vessels with cargoes showed an increase of 92,000 tons or 21 per cent.

OIL TRADE'S GROWTH.

At the last meeting of the Tyne Improvement Commission, the general manager submitted a comparative statement giving particulars of the quantities of fuel and other oils and petroleum spirit discharged and loaded in the port during the years 1926, 1927 and 1928:—

	DISCHARGED.		
	1926 Tons	1927 Tons	1928 Tons
Fuel oil	69,519	112,267	103,229
Mineral oil	2,074	1,752	2,042
Petroleum oil	580	1,841	1,431
Petroleum spirit	3,456	14,617	30,096
	(in drums)	(in bulk)	(in bulk)
	75,629	130,477	136,798
	LOADED.		
	1926 Tons	1927 Tons	1928 Tons
Fuel oil (cargo and bunkers)	77,718	72,792	72,168
Total quantity discharged and loaded	153,347	203,269	208,966

At the annual meeting of Blyth Harbour Commission, Mr. Ridley Warham was re-elected chairman, and Mr. R. W. Sutton deputy-chairman. The chairman of the Finance Committee (Mr. T. E. Forster) submitted the accounts and balance sheet, which showed that the Commissioners' financial position was very satisfactory. The total capital value of the undertaking stands at £1,330,970; the total debt represented by Debenture Stock amounts to £304,350.

It was reported that the shipments for January showed a very satisfactory improvement, and the comparative figures for 1913 and 1928 were as follow:—

1913, 371,381 tons; 1928, 400,126 tons; 1929, 440,356 tons, representing an increase of 19 per cent. and 11 per cent. on 1913 and 1928 respectively.

The chairman, in reviewing the position, said the Commissioners were to be congratulated upon the figures submitted, not only with regard to trade, but financially. The outlook for the next few weeks was distinctly brighter, and he hoped that this long-delayed revival in trade would be steadily maintained throughout the year.

In sharp contrast with complaints of delay are some records of smart work at Blyth. In one case a steamer which arrived at 7 a.m. received 3,300 tons of coal and was completed by 11 p.m. the same day. Another vessel was loaded with 2,750 tons of coal between 3 p.m. and 7 p.m., while a third vessel received 1,300 tons between noon and 8 p.m.

Port Trust for Colombo.

Whether a Port Trust should be formed in place of the existing Colombo Port Commission or not, is the question that is engaging the attention of the Government at the present moment, and a sub-committee of the Ceylon Chamber of Commerce has already been appointed for the purpose. The appointment of this sub-committee is the outcome of an interview which a deputation consisting of the Chamber of Shipping, the Ceylon Association in London, and the Ceylon Chamber of Commerce had with Mr. Amery, the Secretary of State for the Colonies, recently. It is also rumoured that another reason for the appointment of this sub-committee is the recommendation by the Donoughmore Commission that the Port of Colombo should be brought under the control of a Minister.

The first time the question of a Port Trust for Colombo was broached was in 1912, when Sir Henry McCallum, then Governor of Ceylon, appointed a Commission to report upon the condition of the Colombo Harbour and to devise a scheme for the future administration of the port. Sir Hugh Clifford was the chairman of that Commission.

This Commission, among other things, recommended the constitution of a Port Authority for Colombo, in other words, a Port Trust. Sir Henry McCallum, however, disapproved of the Commission's proposals for the formation of a Trust and, in his despatch to the Secretary of State for the Colonies, put forward an alternative scheme for a Port Commission for Colombo which the Secretary of State approved. The present Port Commission is, therefore, a survival of some fifteen years ago, during which period the Colombo Harbour, shipping, trade and all cognate interests have developed at such an extraordinary rate that the present means of administering the port are considered, on all hands, to be out of date and inadequate for the present needs.

As regards the composition of the Authority the Clifford Commission recommended as follows: (1) A Board composed of official and unofficial members; (2) a Chairman, who shall preside at the meetings of the Board, act as its principal executive officer, and conduct with the Government and with the public all correspondence relating to the affairs of the Port of Colombo. The Commission also recommended that the chairman should in the first instance be a Civil Servant of the first class, and should be directly responsible to the Authority for all matters affecting the Port of Colombo. He should exercise a general control over the operations of all the departments of the port.

As regards the terms of office, the Commission recommended that the official members of the Authority should hold their seats during the Governor's pleasure, but strongly recommended that the officers selected to fill the posts of chairman and vice-chairman should be retained in them as long as possible. Among the other recommendations of the Commission were that the Authority should have power to appoint its own officers and to fix their salaries and conditions of service, subject to the approval of the Government that the Authority should frame a Budget, its financial year being the same as that of the Government; that the Authority be given grants-in-aid by the Government in order that the development of the harbour might not be hindered through lack of funds for such a purpose; and that, as the revenues of the port increase, the grant-in-aid might eventually cease altogether.

As regards the revenue of the Authority the Commission proposed that it should be derived from the following sources: Harbour and tonnage dues, pilotage fees, patent slip and graving dock fees, warehouse rent, rents of land, buildings, basins,

commission on coal salved, fees for using tugs and cranes, fines and penalties, etc.

WHY A PORT TRUST WOULD PAY IN COLOMBO.

Mr. T. K. Elderton, the deputy chairman of the Board of Commissioners for the Port of Calcutta, who has been appointed to assist in an advisory capacity the sub-committee recently appointed to go into the question of the proposed establishment of the Port Trust for Colombo, has arrived in Colombo, and addressed a meeting of the members of the Chamber who are interested in the matter. The meeting was not open to the Press, but it is understood that an official report is to be published later.

Interviewed, Mr. Elderton explained the constitution and functions of the Calcutta Port Trust. One very important point mentioned by him was that, in Calcutta, all Government stores imported pay exactly the same charges as goods imported by the commercial community of the public. In Colombo, of course, all Government stores (including railway stores) are admitted free of all rates and charges and pay nothing towards the maintenance and upkeep of the port. The receipts are obtained only from the commercial community.

Government ships and warships pay nothing in Colombo for the use of the port. In Calcutta they pay for all direct services such as pilotage, mooring hire, etc.

So far as expenditure is concerned, in Calcutta the Port Trust would not be debited with the cost of maintaining Customs launches or with the cost of providing any accommodation for the Customs. It would be debited only with a portion of the cost of the Harbour Police and of the Port Surgeon's Department, whereas the whole of the cost of these departments is now debited in the Colombo Port Commission accounts. In other words, the harbour would be placed on a commercial basis much in the same way as has been the Ceylon Government Railway. Moreover, as imported Government stores would be debited with all the charges which privately imported stores have to pay, it would be possible to see whether, in many instances, Government stores could not be purchased more economically locally than through the Crown Agents.

If a Port Trust was established in Colombo, any minor works provided for in the annual Budget could be carried out without any reference to the Government, and major works could be carried out so long as the Commissioners were able to satisfy the Government that they were in a position to finance them. In the case of the Indian Port Trusts that was the sole criterion—whether the Commissioners could satisfy the Government that they were strong enough to finance the scheme for which they sought approval.

A Port Trust enabled those in charge to look well ahead and to prepare a cohesive programme for the gradual expansion and improvement of the port in the confidence that it would be possible to carry out that programme. It made a definite and continuous harbour policy possible. In Calcutta, for instance, as soon as the need for new docks was realised, the necessary land was notified for acquisition and could not be used for any other purpose. In fact, the land for King George's Dock, Calcutta, was acquired in 1909, although work on the dock was not actually begun until after the Armistice.

It should be mentioned that Port Trusts already exist at Calcutta, Bombay, Madras, Karachi, Rangoon, Chittagong, and Aden. All the Indian Port Trusts were established many years ago, and there has never been any suggestion that they possess too much power. Although Colombo, unlike Calcutta, is not a terminal port, it is a very significant fact that the volume of tonnage which annually enters and leaves the Port of Colombo is nearly three times as large as that which enters and leaves Calcutta.

RATES OF EXCHANGE FOR PORT DUES IN YUGOSLAVIA.

The Department of Overseas Trade has received from the Commercial Secretary at Belgrade the following list of official rates of exchange for the payment of port dues in Yugoslavia during the month of March, 1929, which have appeared in the "Official Gazette" of 25th February, 1929:—

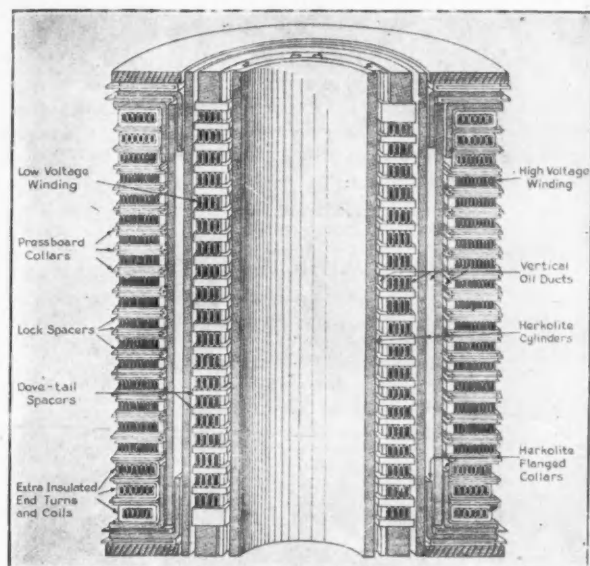
	Dinars
1 Gold Napoleon	218.60
1 Pound sterling	276.50
1 American dollar	56.85
1 Canadian dollar	56.55
1 German mark (gold)	13.53
1 Belga	7.90
100 French francs	222.50
100 Italian lira	298.30
100 Dutch florins	2282.00
100 Roumanian leis	34.00
100 Danish crowns	1516.00
100 Swedish crowns	1519.00
100 Norwegian crowns	1516.50
100 Pesetas	875.00
100 Greek drachmas	73.60

Personal enquiries regarding shipping and transport matters should be made at the City Office of the Department (Shipping and Transport Section), 73, Basinghall Street, London, E.C.2.

Harbour Engineering Notes.

POWER TRANSFORMER WINDINGS.

The diagram illustrates a sectional view of the windings of an extra high-voltage power transformer designed by the B.T.H. Co. The construction ensures that the insulation to earth, as well as between the windings, has the puncture strength of a combination of solid flanged collars and oil ducts. Dependence upon creeping distances, which are inherently unre-



Section through Windings.

liable, particularly in the case of high-voltage transformers connected to overhead lines and therefore exposed to surges, is thus eliminated. Furthermore, it is possible to provide the windings with exceptionally good mechanical support, and at the same time large ventilating ducts, the latter being maintained by interlocked spacers which cannot get out of position.

MECHANICAL METAL COATING.

After a considerably long period of experiment and research, mechanical metal coating is applicable on a commercial scale. The chief mechanical difficulties encountered were the building of a light torch combining automatic wire feed with exceptionally efficient flames to melt the wire instantly as it passed through, and then a compressed air system to blow this molten metal with sufficient speed against the faces to be coated. Another difficulty has been finding industrial applications for the process. Experience in the last few years has shown that, besides the coating of structures, boilers and grates, a very extensive field is the filling up of blowholes in expensive castings, such as calender rolls moreover, the process has been found excellent for building up worn shafts and bearings, thus reclaiming a large amount of material which would otherwise have been scrapped.

A final, and the main difficulty, has been that the process started out by using oxy-hydrogen flames, which, through their oxidising effect, combined with that of the compressed air, deteriorated the quality of the coating. Only since the flames have been changed to oxy-acetylene, with its highly reducing envelope, has it been possible to produce excellent and very little adulterated coatings with most metals.

Nevertheless, even the oxy-acetylene flame has up to recently been unable to produce first-class lead coatings. Lead melts too easily and is affected by the excessive heat of the acetylene, which, together with the effect of the compressed air, oxidises the lead to an appreciable extent. Such coats would neither stick tightly nor resist acid. This seems now to have been overcome by using oxy-acetylene indirectly, by heating up carbonic acid in a torch, and then spraying the overheated carbonic acid against the lead wire to melt it and also spray it, thus enveloping the molten lead with a non-oxidising gas. This is the latest addition to the metal coating art, which has been put into operation by Dr. M. U. Schoop, of Zurich. Lead coating of chemical containers and appliances is quite an important field, and the coating process is claimed to be one of the simplest and quickest methods, while it also avoids to a high degree lead poisoning of the operators.

PULVERISED FUEL FIRING ON BOARD SHIP.

The advocates of pulverised fuel firing are these days turning their attention to the possibilities of this form of fuel for propelling ships in place of oil fuel, and, regarded alone from the economic point of view, the proposition has many attractions. We have no native oil deposits in this country, and the advantages of being independent of foreign supplies of fuel for our ships are obvious. Again, much has been heard lately about fuel

oil from coal, but here we must wait until the scientists and engineers have succeeded in adapting laboratory scale experiments to commercial operations before any appreciable supplies of oil can be expected. True, the distillation of coal to provide coke, say, for industrial and domestic use, coal being prohibited, and oil for internal combustion engines or for steam-raising at sea, has been shown by Bergius and others to be practicable, but so much work remains to be done to make distillation at low temperatures a commercial success that it would be unwise to count upon any extensive supplies of oil fuel for ships within the next few years.

It is claimed by the exponents of pulverised fuel firing that all the advantages of oil firing can be obtained very much more cheaply, provided, of course, that the pulverised coal is used intelligently. It is even confidently expected that within a few years every coal port in Britain will be provided with equipment for storing pulverised fuel and means for pumping it straight into the ships' holds. While it would be rash to make such a prediction, it is obvious that such a practice would aid enormously in solving part, at any rate, of the fuel problem of this country.

As far as actual results are concerned, the U.S. Shipping Board have made successful trials with the s.s. "Mercer," and, according to Dr. C. H. Lander, of the Bureau of Scientific and Industrial Research, the U.S. Shipping Board are now investigating a motor-driven pulverised fuel plant on the unit principle, each boiler being equipped with its own pulveriser, fan and burner. This plant was tested at the Philadelphia Test Navy Yard at the end of last year, and the results are said to come up to full expectations. In America another ship is being built by the Berwindmore Shipping Company, and will be equipped to burn pulverised fuel only.

We have in this country the examples of the s.s. "Stuartstar" and the s.s. "Hororata." The latter is a vessel of some 11,200 tons gross, and is propelled by twin-screw quadruple-expansion engines of about 6,000-h.p. The burner used on this vessel was designed by the Buell Combustion Co., Ltd., the burner being an improvement on the standard Buell burner.

In the Buell burner the pulverised fuel, together with a small quantity of air, is discharged through an annular space round a primary air inlet, through which air is forced from a fan, the annular space being regulatable by means of a hollow cone which forms the end of the inlet pipe. Outside the fuel inlet are two concentric casings, the inner one carrying a pair of conical rings, while the outer terminates in a conical section contracting against the direction of the jet. The external primary air supply from the fan is introduced through the annular space between the concentric casings, either from a continuous chamber, or, more usually, through four pipes connected by a common ring. The secondary air, induced by the injector action of the coal stream, enters through louvres into the space between the inlet pipe and the casing.

In operation, the internal primary air inlet is adjustable horizontally by a screw motion controlled by a hand wheel, the length of the flame being easily regulated. When the adjustment is made for shortening the flame, there is a region of combustion immediately outside the mouth of the burner, where a turbulent effect is very noticeable. The velocity of the coal and air jets being absorbed in creating this disturbance, the resultant flame is short and of a bushy character, with practically perfect combustion. It is also possible to change the direction of the flame from strictly axial to one at a considerable angle to it.

The design of the burner makes it possible to use a wide range of fuels, as complete air control is available. In addition, the burner can be adapted easily to burn either gas or oil, or both, or any admixture of either with pulverised coal. Coals varying from 5 to 30 per cent. volatile have been used with success, and both low and high grade coals can be burnt with success.

There seems to be little doubt that the successful application of pulverised fuel firing to marine boilers has been achieved, though there remain several other technical considerations which must be taken into account.

In the first place: Should ships carry their own pulverising plant on board, or should they rely upon port supplies of fuel ready for burning?

While considerable progress has been made in the design and layout of complete pulverised fuel plants for land installations, it must be remembered that ship's space is valuable, and any pulverised fuel plant adopted for marine purposes must be the essence of compactness. Possibly some equipment on the lines of the unit type pulveriser will solve the problem. Were this type of plant to be adopted, it might include drying equipment, which, of course, adds to the space required, or dryers might be dispensed with. In the latter event the ship would bunker with pre-dried coal and carry out pulverising only on board, the coal being fed automatically into a unit pulveriser and, from there, straight to the burners. This system, of course, has the drawback that thoroughly dried coal could not always be relied upon. On the other hand, were the ship to carry her own dryers and pulverisers, she could coal at any port and prepare the fuel for her own use.

What seems more probable is that ships will coal with fuel ready pulverised, the fuel being drawn into the ship's bunkers through suction piping. In this case, it seems, there is a possibility of spontaneous ignition in the pulverised fuel, though, if the proper precautions were taken, as they would have to be before the system could be adopted, there should be no danger at all.

This difficulty, it may be remembered, was overcome in the Australian vessel H.M.A.S. "Skylark" by storing the pulverised coal in sealed bunkers and then filling the space at the top of the bunkers with inert gases from the stack. This vessel was run for three years on pulverised fuel without any mishap.

In this connection the important point to remember is that the coal must be perfectly dry and cold when bunkered. Warm, moist coal provides just those conditions which are required for spontaneous ignition. This, of course, can be overcome in the port storage bunkers, and by designing pulverised fuel bunkers on ships with an air space separating the bunker sides from the ship's plates. With such precautions, there should be no fear at all of spontaneous ignition.

That the adoption of pulverised fuel on an extensive scale by shipping companies would lead to enormous economic benefits to this country is obvious, for it would place a cheap fuel within the reach of ships and would provide the mines with an outlet for much small and low grade fuel that is at present unsaleable.

Dublin Port and Dock Board's Accounts.

Mr. E. H. Bailey, Secretary, Dublin Port and Docks Board, in the course of his annual report, says that the statement of accounts for 1928 shows a gross revenue of £200,502 14s. 10d., a total expenditure of £184,543 16s., and a revenue surplus of £15,958 18s. 10d.

As a result of the Board's offer to holders of Short Term Mortgage Bonds offering to convert the Bonds into the Board's 5 per cent. Stock or to pay them off, Bonds amounting to £101,500 were converted into Stock and Bonds amounting to £105,969, were paid off and replaced by issues of the Stock.

In addition, Mortgage Bonds to the amount of £7,650 were paid off out of the Sinking Fund; the amount of Short Term Bonds being reduced from £313,244 at the end of 1927 to £98,125 at the end of 1928.

Loans outstanding at 31st December, 1928, amounted to £1,149,761 4s. 11d., the balance to credit of the various Sinking Funds at that date being £141,181 15s. 6d.

The Dublin Port and Docks Board (Bridges) Bill providing for the rebuilding of Butt Bridge and the building of a Transporter Bridge connecting the North Quays at Guild Street with the South Quays, came before the Joint Committee of the Oireachtas, and evidence having been heard, the Bill, as amended, passed the Committee stage.

REGISTER TONNAGE.

The total register tonnage which entered the Port of Dublin during the year, and upon which dues were paid was 2,298,920 tons, showing an increase of 27,073 tons as compared with 1927.

IMPORTS.

Description	Foreign Tons	1927		Foreign Tons	1928	
		Cross Channel Tons	Irish Coasting Tons		Cross Channel Tons	Irish Coasting Tons
General Goods	487,805	468,957	16,122	457,727	485,403	12,436
Coal	—	1,080,183	—	—	1,089,334	—
	Loads	Loads	Loads	Loads	Loads	Loads
Timber (all kinds)	73,437	4,198	—	75,579	4,751	2

EXPORTS.

Description	Foreign Tons	1927		Foreign Tons	1928	
		Cross Channel Tons	Irish Coasting Tons		Cross Channel Tons	Irish Coasting Tons
General Goods	56,059	399,795	20,146	50,961	374,507	21,453
	Loads	Loads	Loads	Loads	Loads	Loads
Timber (all kinds)	—	13,534	137	—	10,338	190

TOTAL GOODS IMPORTED AND EXPORTED

(One load of trucks taken as equal to one ton).

		1927	1928
		Tons	Tons
Imports	...	2,130,702	2,125,232
Exports	...	489,671	457,449
		2,620,373	2,582,681

LIVE STOCK EXPORTED.

		1927	1928
		Tons	Tons
Cattle	...	359,710	378,160
Sheep	...	354,898	368,475
Pigs	...	103,477	88,750
Horses, etc.	...	5,830	5,631

Mr. Joseph Mallagh, Assoc.M.Inst.C.E., Chartered Civil Engineer, in the course of his report as Engineer of the Dublin Port and Docks Board, states that the Board's plant dredged for maintenance during 1928, 811,125 tons from the bar in the river channel, Alexandra Basin, Quay berth, and Pigeon House Harbour.

An extension of the pump-house at graving dock for Harbour Master's department was undertaken.

The reconstruction of Alexandra Wharf was commenced, the reinforced pontoon construction which was successfully used in the Deepwater Quay being again employed.

Butter and egg inspection rooms were provided in the sheds allocated to three of the cross-channel shipping companies.

The four-ton electric crane ordered in 1927 was handed over by the builders and has given complete satisfaction in working.

At the Custom House Docks, a contract was entered into for the erection of an additional warehouse.

The filling up of the Old Dock has made considerable progress.

New Appointment.

Mr. A. Dunbar, of the Elswick Works of Messrs. Vickers-Armstrongs Limited, has been appointed a Special Director of that Works. Mr. Dunbar has been in the service of Messrs Vickers Limited and Messrs. Vickers-Armstrongs Limited for



Mr. A. DUNBAR.

25 years. He was trained at Barrow-in-Furness, leaving there in 1910 to take up a position at the Erith Works. In 1916 he joined the Staff of the Company's Aviation Works at Weybridge, and in 1923 he became a member of the Head Office Staff in Westminster. In 1928 he went to Elswick.

THE ENGLISH STEEL CORPORATION, LTD.

The Board of the English Steel Corporation, Ltd., has now been constituted as follows:—

Mr. G. R. T. Taylor (Deputy Chairman), General Sir J. F. Noel Birch, G.B.E., K.C.B., K.C.M.G., Commander C. W. Craven, R.N., Mr. W. L. Hichens, Mr. T. L. Taylor, Mr. R. Whitehead, J.P.

Owing to his appointment as Deputy Chairman of the English Steel Corporation, Ltd., Mr. G. R. T. Taylor has resigned his post of Deputy Chairman of Vickers-Armstrongs, Ltd., but remains a director on the Board of that company. Mr. G. G. Sim has been appointed Deputy Chairman of Vickers-Armstrongs, Ltd., in place of Mr. Taylor.

Commander C. W. Craven, R.N., is appointed Managing Director of the Vickers-Armstrongs' shipyards and works at Barrow-in-Furness and Newcastle.

The Port of New Orleans.

NEW ORLEANS PORT TRAFFIC IN FEBRUARY.

The increase in the amount of deep-sea freight traffic passing over the public wharves of New Orleans in February, 1929, as compared with business of the same month of 1928, was 23,000 tons. The total movement was 350,298 tons of general merchandise, 49,932 tons of grain, and 34,294 tons of ore. These figures do not include traffic at private wharves and industrial plants.

During the month there arrived in port 237 deep-sea vessels of 929,572 gross register tons, of which 762,360 tons used the wharves of the Board of Commissioners of the Port of New Orleans. Banana imports amounted to 1,471,255 bunches.

Traffic on the inner harbour navigation canal for the month of February amounted to 706 vessels of 342,292 tons, an increase of 16,505 tons. There was increased use of the canal by ocean-going tonnage and by barges, but a slight decrease in the number of transits by miscellaneous small boats.

River craft arriving at the port numbered 245 vessels of 100,121 tons, exclusive of craft under 25 tons register.

An unusual import shipment during the month was 3,471 bags of green coffee, brought by the O.S.K. ss. "Santos Maru" from Buenos Aires. Coffee imports are almost always received from the ports of Brazil, and it is said that this shipment from Buenos Aires was carried by river barges downstream from Brazil to the Argentine port.

The arrivals of ocean-going tonnage at New Orleans in February are shown in the following table:—

Flag	Number of Vessels	Gross Tonnage
American	125	552,716
British	24	104,175
Brazilian	2	8,624
Danish	3	9,087
Dutch	1	8,854
French	2	15,173
German	3	5,791
Honduran	32	84,729
Italian	9	50,421
Japanese	1	7,267
Nicaraguan	2	3,154
Norwegian	27	65,102
Panamanian	2	1,336
Swedish	4	13,143
Total	237	929,572

NEW QUARANTINE WHARF TO BE CONSTRUCTED.

The Board of Commissioners of the Port of New Orleans have granted permission to the U.S. Treasury Department to construct on the west bank of the Mississippi a new quarantine wharf which will occupy a frontage site already owned by the Government. The location is between Lincoln and Richland Roads, and a short distance below the immigration station.

The construction of this station in the heart of the harbour will prove a great advantage to shipping, obviating delays at the head of the passes or at the anchorage grounds at the Flood Street station, where accommodations are inadequate.



Riverfront View of Poydras Street Green Coffee Shed. Travelling Cargo Bridges to connect the Second Floor with Ship's Tackle had not been installed when this photograph was taken. The Shed has been used since October last, when the S.S. "Salvation Lass" arrived with Brazilian Coffee. Over 3,000,000 bags of coffee are to be handled annually through this shed.

The proposed structure will consist of a wharf 28-ft. by 55½-ft., served by a float which connects with the wharf by a stairway adjustable to all river stages. A gangway and bridge 10-ft. wide will lead back approximately 250-ft. from

the wharf to the top of the levee, and concrete ramp and steps will lead from the public highway to this gangway.

CONSTRUCTION PROGRESS ON ST. ANDREW STREET WHARF.

The Board of Commissioners of the Port of New Orleans on February 28th authorised a contract with the O'Brien Construction Company for woodwork in the rear extension of the St. Andrew Street Wharf, for the sum of \$14,701.50, the lowest



Poland Street Wharf Extension, interfered with by high stages of the River, which prevented completion of foundation work for steel erection. This Wharf Shed connects with a Six-story Warehouse in rear by means of runways leading to the first, second and third floors.

bid submitted. Contracts let to date on this project total \$243,490, the estimated final cost being \$525,000. It involves the raising and extending of the present shed, laying of reinforced concrete deck, and erection of firewalls.

Bremen Shipping Traffic in January, 1929.

The Department of Overseas Trade has been informed by the Acting British Consul at Bremen that the volume of shipping entering Bremen for the month of January amounted to 493 vessels of 792,510 net register tons showing an increase of 26,000 net register tons, or four per cent., as compared with the month of December, and an increase of 54 vessels of 82,000 net register tons, or twelve per cent., compared with January, 1928.

The figures for the outgoing traffic for January show a total of 475 vessels amounting to 793,526 net register tons as compared with 432 vessels with a tonnage of 696,829 for January, 1928.

Importation of sea-borne goods in the five most important Weser ports amounted to 401,600 tons, 42,000 tons less than the figures for December, 1928. This is stated to be due chiefly to decrease in the volume of imports of cotton and timber. Exports amounted to 158,700 tons.

The following statistics show the division of traffic amongst the various Weser ports for January, 1929, as compared with the same month of last year.

	January, 1929.		January, 1928.	
	Vessels.	Net Reg. Tons.	Vessels.	Net Reg. Tons.
INCOMING.				
Bremen	387	574,900	352	505,020
Bremerhaven	105	226,750	70	189,296
Vegesack	1	378	2	392
Wesermuende	8	787	10	998
Brake	12	16,696	15	22,314
Nordenham	4	4,405	11	17,047
Total	517	823,916	460	735,067
OUTGOING.				
Bremen	365	532,605	326	479,591
Bremerhaven	123	263,910	81	192,189
Vegesack	—	—	1	29
Wesermuende	—	—	—	—
Brake	5	10,120	19	22,563
Nordenham	3	3,824	13	20,521
Total	496	810,459	440	714,893

Personal enquiries regarding shipping and transport matters should be made at the City Office of the Department (Shipping and Transport Section), 73, Basinghall Street, London, E.C.2.

Annual Report of the Belfast Harbour Commissioners.

The statement of accounts for the year 1928 shows a gross revenue of £276,811 4s. 4d.; a total expenditure of £264,307 6s. 4d., and a net surplus of £12,503 18s.

The net register tonnage of vessels cleared from the port during the year totalled 3,070,986 tons, representing a decrease of 50,753 tons on the previous year, and the tonnage of goods imported and exported, viz., 3,137,919 tons, shows a decrease of 169,512 tons.

New tonnage constructed in the shipbuilding yards on the Harbour Estate and cleared during the year comprised 16 vessels of 90,482 tons gross and 53,372 tons net register.

The Sinking Funds continue to be maintained in a satisfactory condition, and Belfast Harbour Redeemable Consolidated Stock to the extent of £9,500 was purchased out of the funds and extinguished during the year.

During the year the Commissioners held 33 Board meetings and 115 meetings of Standing and Special Committees.

The Engineer's (Mr. T. S. Gilbert, M.Inst.C.E., Engineer-in-Chief) Annual Report as to the condition and progress of harbour and dock works for the year ending 31st December, 1928, is as follows:—

CONTRACT WORKS.

Extension of Goods Shed, Dufferin Dock (West Side).—The work of extending the Goods Shed on the west side of Dufferin Dock for a length of 613½-ft. and a width of 71-ft., was satisfactorily completed by the contractors (Messrs. McIntyre Bros., Belfast) in the month of July last.

Four 5-ton Electric Cranes.—The contract which was entered into with Messrs. Alexander Chaplin and Co., Ltd., Govan, Glasgow, in October, 1927, for the supply and erection of four 5-ton electric travelling gantry cranes, is nearly completed. Three of the cranes have been erected and tested with satisfactory results—two on Albert Quay and one at the south end of Abercorn Basin—whilst the erection and testing of the fourth crane on Albert Quay will be completed in the course of a few days.

New Steam Tugboat.—A contract was entered into with Messrs. George Brown and Co., Shipbuilders, Greenock, in the month of January last, for the supply of a small tugboat to replace the s.t. "Lagan." This contract was satisfactorily carried out, and the boat (s.t. "Craigavad") was delivered in the month of August.

Passenger Elevator, Harbour Office.—In December, 1927, a contract was entered into with Messrs. Waygood-Otis, Ltd., London, for the supply and installation in the harbour office of an automatic passenger elevator. This contract has been duly completed.

Three New Electric Transporter Cranes.—A contract has been entered into with Messrs. Alex. Chaplin and Co., Ltd., Govan, Glasgow, for the supply and erection on Donegall Quay (at the berth occupied by the Liverpool Steamers), of three electric transporter cranes, having a lifting capacity at different radii, of 3 and 5 tons, 5 and 7 tons, and 10 and 12 tons, respectively. Some of the structural and detail drawings of these cranes have been submitted by the contractors, and passed.

New 5-ton Self-Tipping Motor Lorry.—In the month of June Mr. Arthur Stringer, Belfast, contracted to supply one new 5-ton Maudslay hydraulic self-tipping lorry. This vehicle was delivered in August.

Steel Tramway Rails.—In July last Messrs. P. and W. MacLellan, Ltd., Glasgow, contracted to supply 150 tons of new steel girder tramway rails together with the requisite fishplates. This contract was satisfactorily fulfilled in the month of September.

NON-CONTRACT WORKS.

Albert Quay.—The northern portion of the Albert Quay has been strengthened to carry the new electric cranes. This work involved the provision of a number of new stay piles, tie-rods, etc.

The greater portion of the old steam craneline on this quay has been removed, and about 700 lineal feet of new rail for the electric cranes laid down.

The tramlines have also been re-arranged, a length of about 4,000-ft. of new single track having been laid down together with the necessary switches and crossings.

Ten new mooring pawls have been placed in position, and a considerable amount of square sett paving done.

Prior to the commencement of the work, a cross-over road, about 300-ft. in length, was laid through the Albert Quay coal yards, thus enabling rail traffic to be carried on as usual during the alterations referred to.

A brick building, comprising an electric sub-station and an office for the Cranes Department, has been erected on the south end of the quay.

New Shed and Jetty at Queen's Quay, South End.—A shed measuring 160-ft. by 50-ft., and a jetty 120-ft. in length, have been constructed at the south end of Queen's Quay for the accommodation of trans-Atlantic passengers. Rooms have been

provided in the shed for the use of H.M. Customs and Medical Officers.

New Jetty at Connswater.—A new jetty, 150-ft. in length, has been constructed westward of the Sydenham reclamation area for the use of Messrs. John McCausland and Son in connection with their shipbreaking business.

Widening of Sheds, Donegall Quay.—The work of widening by 15-ft. the sheds along Donegall Quay for a length of 965-ft. was completed during the past year.

Extension of Roadway to Oil Jetty, Musgrave Channel (Relief Work).—This work was completed in the month of February last.

Approach to Dee Street Bridge (Relief Work).—Two square-setted tracks, each 650-ft. long by 10-ft. wide, with a 20-ft. wide concrete track between them, have been made in order to improve the approach to this bridge.

Concrete Tracks (Relief Works).—A concrete track, about 800-ft. in total length and 15-ft. in width, has been laid down in the Clarendon Graving Dock Yard, and a similar track has been laid along the centre of the Northern sections of the Donegall Quay Shed, from Clarendon Dock entrance to the south end of Albert Quay—a length of 976-ft.

Reclamation Bank (Relief Work).—The construction of an additional bank on the foreshore between Sydenham and Tillysburn for reclamation purposes has now been completed. This bank encloses approximately 60 acres, and (in addition to the three last mentioned works) has afforded employment for a considerable number of men.

Miscellaneous Works.—A commencement was made in the month of October with the improvements ordered to be carried out in connection with the Commissioners' Workshops at Clarendon Dock. This work is in hand.

The work of strengthening the South Quay of Clarendon Dock is also in hand.

An electric cable has been laid, and lamp standards erected, along Sydenham Road between Cuming Road and East Road, for the purpose of lighting this area.

The renewing of the front portion of the submarine concrete, etc., in the north pier of the 120-ton crane has been completed.

The concrete floor in the new shed extension on the west side of Dufferin Dock was laid by their own workmen.

The store behind the new shed on the North-West Quay of Clarendon Dock, formerly occupied by Messrs. J. Lytle and Sons, Ltd., has been repaired, and a concrete floor laid.

The chimney of the old pumping station at Hamilton Graving Dock was taken down in the month of May last.

Dredging.—The total spoil raised from the various channels, docks, quays, etc., by the Commissioners' plant during the year amounted to 617,468 tons, and this spoil has all been pumped ashore by No. 4 Dredger on to the reclamation ground in the vicinity of Sydenham.

Reclamation Land, Made-up Ground.—During the year about 14 acres of reclaimed land in the vicinity of Sydenham were made up to quay level, and 60 acres were embanked and reclaimed from the sea.

Ordinary Maintenance and Repairs.—The various works comprised within the limits of the Harbour Estate, together with all land and floating plant, channel lights, machines and implements, etc., have been efficiently maintained during the year.

GRAIN DISCHARGING AT PIRAEUS.

The Department of Overseas Trade has been informed by the Greek Legation in London that the Piræus Harbour Authorities report that all steamers entering that port carrying grain may go alongside the quay and unload their cargoes direct on the quay.

By this improvement it is estimated that the daily unloading of grain is now increased to 600 tons, instead of only 400 tons, and that, further, the construction and erection of up-to-date silos in the harbour is expected to be completed and ready for use at the beginning of next year.

Personal enquiries regarding shipping and transport matters should be made at the City Office of the Department (Shipping and Transport Section), 73, Basinghall Street, London, E.C.2.

KIEL CANAL TRAFFIC IN JANUARY, 1929.

A report received by the Department of Overseas Trade from His Majesty's Consul-General at Hamburg states that there was a considerable drop in the volume of traffic through the Kiel Canal during the month of January, 1929, and only 2,503 vessels aggregating 1,258,936 net reg. tons passed through the canal. The decrease was directly attributable to severe ice conditions, which continued throughout the entire month. The traffic during January, 1928, amounted to 2,836 vessels of 1,281,905 net reg. tons. Of the 2,503 vessels, 1,988 were registered as seagoing steamers aggregating 1,171,561 net reg. tons, 1,704 were cargo and passenger vessels aggregating 1,159,225 net reg. tons, 159 tugs aggregating 6,505 net reg. tons, 75 fishing steamers of 5,835 net reg. tons, 314 sailing vessels of 23,802 net reg. tons, and 219 were lighters and barges of together 49,010 net reg. tons.

Personal inquiries regarding shipping and transport matters should be made at the City office of the Department (Shipping and Transport Section), 73, Basinghall Street, London, E.C.2.

Oxy-Acetylene Welding in Industry.

During recent years there has been so much talk of electricity that the engineering industry, in many of its branches, has come to think that all welding operations in the future will be carried out by electricity, and a large number of firms who have used gas welding and cutting equipment have retained old and out-of-date apparatus until such time as they feel inclined to replace it with electrical plant. However, the view that there is no future for gas welding and cutting is very mistaken, as is shown by a compilation of reports on progress of this art made by the International Acetylene Association, which has its headquarters in New York.

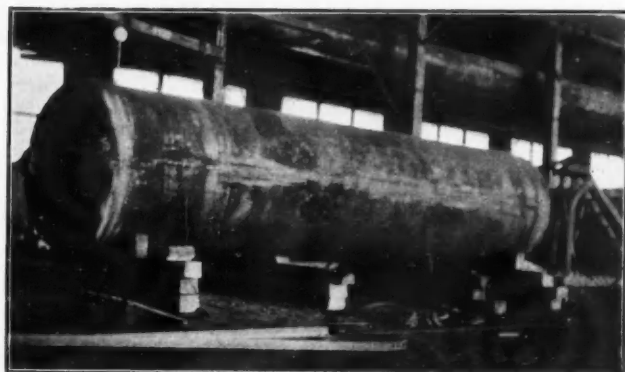
The materials and applications of oxy-acetylene welding have now been to a very large extent standardised, and it does not require any very extensive argument to show that iron and steel remain the outstanding of all manufactured metals as far as welding is concerned. In fact, it was only a few years ago that these were the only metals other than cast iron that could be commercially welded, and a man who could weld manganese steel or aluminium was considered a past-master of his art. To-day, however, every known commercially used metal can be welded by the oxy-acetylene process, and there is a suitable welding metal for each. Alloy steels, stainless steels, acid-resisting iron, corrosion-resisting bronzes, aluminium, manganese steel, monel metal, stellite, copper and bronze mixtures of every nature are being welded successfully.

In this connection, the following list of metals, together with welding metals or fillers is interesting. This list has been compiled from the records of many of the most successful firms in the industry, and the writer is indebted for it to Mr. H. S. Card, chairman of the International Acetylene Association:—

METAL.	WELDING MATERIAL.
Aluminium castings	Cast aluminium bars of same analysis
Aluminium sheet	Pure aluminium wire of same analysis
Brass, sheet and castings	Tobin or manganese bronze rods
Bronze	Manganese bronze rods
Copper	Tobin or manganese bronze rods
Cast iron	Cast iron bars
Chrome-nickel steel	Chrome-nickel steel rods
Duralumin	Pure aluminium wire
Duriron	Cast duriron bars
Everdur	Everdur cast bars or wire
Gray iron	See cast iron
High carbon steel	Special high carbon rods or wire
Iron	See steel
Lead	Pure lead wire
Malleable iron	Tobin or manganese bronze rods
Manganese steel	Manganese steel wire
Monel metal	Monel metal wire
Molybdenum steel	Same as used for regular low and medium carbon steels
Chrome iron alloy (such as stainless iron and steel)	Cast bars or wire of same analysis
Steel, all shapes	Low carbon steel wire
Stellite	Stellite cast bars
Vanadium steel	Vanadium steel wire
Wrought iron	Same as low carbon steel
Nickel steels	Nickel steel wire

Special fluxes for all these metals are, of course, available.

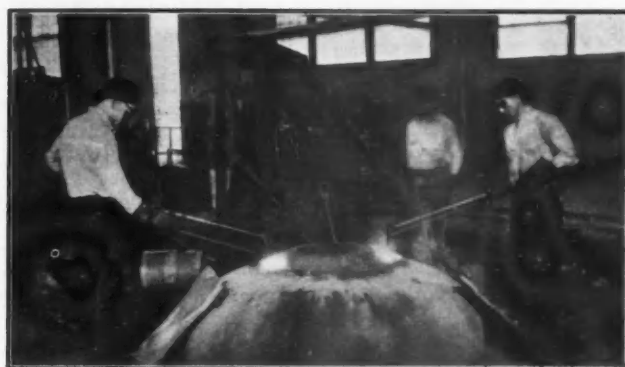
The oxy-acetylene operations that can be carried on profitably on railway equipment, for instance, are to a great extent



High-pressure vessel welded by oxy-acetylene process.

standardised by long usage under uniform conditions and in connection with railway equipment that is fundamentally uniform. Therefore, the most notable progress in recent years is not in the discovery of new applications and methods, but pertains to a wider adoption of the known oxy-acetylene operations by many railway systems that were more or less sceptical about the economy or the practicability of these specific operations.

In power plant construction, gas welding and cutting is used largely in sheet metal work. Such material is often cut and built up on the site, with considerable savings in the elimination of very detailed drafting layouts to determine exact clearances, saving the ordering, handling and storage of special pieces cut in the mill, and reducing the necessity for flange-hand-bolt assembly. In construction work, gas welding is often found



Oxy-acetylene welding the end of a high-pressure vessel.

indispensable in the fitting of metal parts which are not quite true to dimension and which would otherwise have to be returned to the shops. As many as twelve welding units have been in use simultaneously in the construction of one station. Gas welding has been used in assembling a 20-in. steam heating main where flanges and bolts have been eliminated except as expansion joints. At 200-lb. pressure, this 4,000-ft. line has given no trouble in four years of intermittent operation.

The use of acetylene and oxygen in shipyards and ship repair plants is very extensive, and has proved both economical and a time-saver, and also made possible work which could not otherwise have been carried out satisfactorily. The most outstanding usefulness of these gases are found in the cutting of steel in the form of plates, shapes, such as angles and channels, heavy billets up to 20-in. thick for forgings, risers on steel and iron castings and in the cutting of steel and iron piping. Not only is this cutting valuable for new work, but to an even larger degree it is of great use in repair work, and, as an example, the cutting out of 100 $\frac{1}{4}$ -in. countersunk rivets in one hour gives some idea of the time saved.

In the fabrication of structural steel, welding has advanced well beyond expectations. From the start, the advocates of structural welding, which not alone includes the welding of structural building steel, but rolled steel products for structures of all classes, have aimed high, and the activities in this field have been exceedingly promising. The significance that can be ascribed to this success is none other than that sound welding intelligence guided the entire development. The welding industry has learned that each case of welding requires a specific procedure control, and, when such is allowed, the results are invariably satisfactory. This knowledge was available when the welding of structural steel was included; however, extensive supplementary tests were conducted to verify the then existing data before any major commercial structures were welded. Many of these tests were on full scale plant, and included column and beam connections, built-up girders and roof trusses.

During the past year the applications of the oxy-acetylene process in the welding of pipe lines have in some countries become the recognised standard practice, and since a pipe line was completed between Denver and Amarillo there has been no major project in America that has not used welding to at least 50 per cent., and very nearly all pipe lines under 16-in. diameter have been solidly welded. The year has seen a marked invasion of this field by the electric welding process, though gas welders are confident that their industry is not seriously threatened. Oxy-acetylene welders can point to one pipe line 1,330 miles long; another 530; one has just been completed for over 300; and some ten systems over 200 miles long have been all gas welded. The diameters range from 8-in. up to 20-in.

Probably no application of gas welding has taken a greater stride forward than welding in the construction of industrial piping for high and low pressure steam, water, compressed air and other industrial services.

One firm alone has welded 200 pressure vessels in wall thicknesses up to 14-in., with diameters up to 90-in. and up to 90-ft. in length, the working pressures ranging up to 300-lb. per sq. in. A typical example of this type of construction may be cited in the case of a creosoting unit recently built throughout by gas welding. The plant was designed for a fibre stress of 9,000-lb. per sq. in.

Sheet metal welding is one of the oldest and most important branches of oxy-acetylene welding. It embraces many types of welding, and the technique, even on similar classes of work, is found to vary greatly, depending upon the requirements of the particular job. Each year shows a general advance in the many applications of gas welding, and a recent notable advance has been the welding employed in aircraft construction, not

so much for covering the all-metal planes as in the joining of the steel tubular members of all types of craft. These tubes are both plain carbon steel and alloy steels. This development started in aircraft work through the building by welding of the sheet metal fittings used at panel points for the attachment of the main spar members and rigging wires in planes of composite construction. The change from this construction to that of the all-welded tubular structure, which includes engine mountings and, recently, even the main wing girder members, is indeed a marked advance.

One of the great advantages of the gas welding process, which is largely responsible for its use by the sheet metal worker, is the fact that the process is extremely flexible and permits a wide tolerance in the shearing and forming operations. This, in turn, means a degree of latitude that shows appreciable profits when the final and complete account is considered. From a slightly different viewpoint, the adaptability of welding is illustrated by the ease of transition from the small jobbing shop employing a few welders, to large factories employing many welders and turning out a large mass of repetitive work. No great changes are required, nor any scrapping of gas welding tools or equipment, for the big shop uses the same tools and processes with only slight modifications.

In the motor car industry, gas welding plays an important part in new construction, in reclamation work and repairs. The main sheets of steel and aluminium bodies are fabricated and posts and reinforcing members joined, particularly at points that are exposed and therefore finished, by gas welding. Mufflers, intake and exhaust manifolds, oil pans, frame brackets and stiffeners, and a great many of the smaller pressed metal parts are assembled and joined by welding. The repair shop makes a widely varied use of welding, extending from simple fender, axle and frame work to involved body repairs and rebuilding.

In an entirely different type of construction falls the complete range of gas welded tanks, which are far too numerous to be discussed in detail here. Some of the more important that should be mentioned are the tanks and vats used for dyeing, mixing, bleaching and allied processes. These can be made in their entirety by welding of non-corrosive metals such as nickel, monel, stainless steels, and, in some cases, aluminium. In some industries we find gas-welded bobbins, rollers and spinners, sometimes made of steel, but frequently made of non-corrosive materials. Gas welding is found particularly suitable for this class of work, because of the density and freedom from porosity of welds made by this process.

One of the newer and important applications of modern sheet metal work is the construction of the all-metal domestic refrigerator, which is entirely or partly gas welded, depending upon the nature of the construction. In manufacturing refrigerators of composite construction the steel linings can be gas welded throughout. Because finishes of high lustre can be applied over a gas weld without the line of the weld showing through, gas welding is very valuable for products that require vitreous enamel and porcelain finishes.

In dairy equipment, for sanitary reasons, the seams or joints must be so made that when the equipment is cleaned no traces of milk or other contents shall remain to sour and otherwise cause trouble through bacterial infusions. It is also important that seams which are protected by a coating must not cause the coating to deteriorate along the line of the joint before the entire container is worn out.

There is still another form of sheet metal work that should be included, namely, "lead burning," as it is generally called. Gas welding is employed extensively for sheet lead work, such as the construction of special storage batteries where the case is made up of wood and lined with lead. Vats and pickling tanks of all kinds are well-known to users of sheet lead.

To make possible the diversified kinds of work that have been briefly referred to above, a wide range of styles and sizes of torches and tips for sheet metal work have been produced, and tips are designed to give special flame characteristics suitable for the job in hand.

Irish Harbour Matters.

LIMERICK HARBOUR FINANCES.

According to the statement made by Mr. John Power, secretary to the Limerick Harbour Board for the year ending 31st December, 1928, vessels entering the Port of Limerick numbered 455; registered tonnage, 242,301, an increase of 28 vessels on the previous year, and a tonnage increase of 8,008. The revenue from imports was £25,784 19s. 5d., an increase of £473 3s. 1d. The income amounted to £29,627 9s. 10d., showing an increase of £1,183 15s. 10d. Expenditure totalled £14,796 14s. 8d., an increase of £870 17s. 8d. over last year, to which must be added capital expenditure £552 6s., principally for cattle pen extensions.

Cattle exports increased from 6,901 in 1927 to 9,184 in 1928. Butter exports increased from 2,064 tons in 1927 to 3,328 last year, while egg exports increased from 583 tons in 1927 to 707 tons last year.

The Commissioners have no liabilities, and have invested in the Free State 5 per cent. Loan and the 5 per cent. War Loan; £47,262 1s. 8d. outstanding debts due by the Commissioners, £2,660 have been paid off, and all but £10 collected of £1,788 5s. 5d. due to the Commissioners.

CORK HARBOUR PILOTAGE DUES.

No agreement has yet been reached in the dispute between the Cork Harbour Commissioners and the trans-Atlantic Shipping Companies in regard to the pilotage dues on liners calling at Cobh (Queenstown). The companies have protested against the exclusion of their vessels from participation in the Board's proposed reversion to a pre-war scale of pilotage dues on cargo vessels. Although a compromise was effected at a conference between the companies and the Pilotage Committee, the committee's recommendations were not acceptable to the majority of the Commissioners. As the scale finally adopted by the Board has already been refused by the companies affected, Galway's challenge to Cork as a port of call for American liners looms large on the horizon.

CORK SHIPYARDS CHANGE HANDS.

It is understood that the Cork Harbour Ship Repairing Yards of Messrs. Furness, Withy and Co., at Rushbrooke and Passage West, Co. Cork, have passed into the possession of Messrs. Beardmore.

PROPOSED GALWAY HARBOUR IMPROVEMENTS.

At the instance of a Joint Committee comprising representatives of the Galway County Council, the Galway Urban Council and the Galway Harbour Board, Sir Cyril Kirkpatrick, late Chief Engineer to the Port of London Authority, with Sir John Griffith, Mr. W. N. Binns, and Mr. M. J. Kennedy, have furnished a report, draft scheme and estimate for improving the inner harbour at Galway.

The engineers were directed by the Joint Committee to provide for the following requirements:—

- Facilities for accommodating ocean-going cargo boats of reasonable tonnage at Galway Commercial Docks.
- Facilities for accommodating a passenger carrying tender at all states of the tide.
- Facilities for accommodating fishing boats at all states of the tide and in all weathers.
- The estimate for the scheme to be about £200,000.

The proposed scheme consists of deepening by dredging the approach channel; the deepening the rock cutting the entrance to the dock and the berthage behind proposed new pier; the construction of this pier; the erection of dock entrance gates; the deepening and enlarging of existing (deep) small dock and the connecting of this with the existing commercial dock; the deepening of the commercial dock and the construction of quay walls with them; and, finally, the filling in of the existing entrance to the commercial dock.

The estimated cost of the first stage of the scheme up to the deepening of the commercial dock, etc., is £249,738; while the deepening of the commercial dock, filling in of the entrance to same, and the connecting of the small and the commercial docks will cost £85,844.

The scheme is designed to make provision for vessels drawing 20-ft., length 325-ft., and approximate tonnage 4,000.

Such vessels can enter or leave the dock within one hour of high water of the lowest predicted tide, with 2-ft. clearance over the centre of the sill.

GARSTON DOCK IMPROVEMENTS.

We are advised by the L.M. and S. Railway that a large part of the £200,000 scheme for improving facilities at their Garston Docks has already been completed. Work is proceeding rapidly and the remainder of the scheme will be completed in time for the 1929 timber season.

The improvements include:—Additional timber storage area of about 35 acres with additional siding accommodation for 1,155 wagons. Other accommodation is being provided for 170 additional wagons. A new commodious shed for fine wood goods is in course of erection and is expected to be ready for use at the end of April. Additional and improved siding accommodation at Park Sidings, North Dock, Stalbridge Dock and High Level. Crane facilities modernized and increased, including 4 seven-ton electric luffing grab cranes. Seven coal tips reconstructed to take 20-ton loads.

The first of the new electric cranes has been installed and all four are anticipated to be ready for use by the end of April.

Despite the fact that the total timber traffic handled at Garston in 1928 was equal to that of 1927 (a peak year) no congestion occurred. The improvement scheme at present in hand is adequate to deal with any business they may be offered with ample margin for future expansion.

Jetties in Tidal Waters.

THE TERMS JETTY, WHARF, QUAY, are quite frequently loosely applied. The former, from the derivation of the word, naturally implies a structure "thrown out," that is to say, built out from the shore into deep water for the purpose of obtaining sufficient depth of water for berthing vessels without recourse to over much dredging.

Wharves and quays are generally the terms used for structures built along the shore or bank. They may be of the open-piled type of construction, or more usually solid; either with a sheet piled face with solid filling, or built with walls of mass concrete with filling behind. Quay is usually the term applied to berthage in docks, built on the same principles. With wharves, quays and jetties constructed in docks or basins we are not, in these notes, concerned, neither with that type of berthage which is very largely used in American and continental ports in preference to wharves or quays along the shore. Such jetties are usually solid structures constructed with some kind of wall or sheet piled face on both sides, the interior being filled solid with earth; and project in the form of jetties from the general line of the sea or river front.

Opinion as to what constitutes the limiting range for the natural tidal working of ports has undergone considerable change in recent times.

Some years ago, 12-ft. to 15-ft. rise of tide was accepted as the maximum for berthing vessels of a tonnage of from about 6,000 tons and over, principally on account of the risk entailed by accidental breakage of moorings, which require attention at all times, as also the risk involved when berthing and unberthing the ships in a tideway having possibly several knots speed.

However, there are now many jetties in British waters with a tidal range up to 22-ft., notably in the River Thames where vessels of 20,000 tons and upwards of 30-ft. draught are accommodated at tidal jetties.

At the Port of Havre, new berths are being provided in tidal waters where the range of tide is about 22-ft.

The majority of the port accommodation of the world appears now to be tidal, mainly owing to the moderate range of tide at most places, and the next few years are likely to see a large increase in this tidal accommodation for vessels of considerable size.

Circumstances, however, do not always wholly favour the construction of jetties, for they encroach upon the waterway in rivers and estuaries of moderate size, and thus tend to obstruct navigation. On the other hand, riverside wharves or quays, although possibly perfectly accessible from the waterside, have a tendency to become inconvenient and unwieldy from the point of view of shed, railway and road accommodation and access.

The Rivers Thames, Tyne and Clyde are comparatively narrow rivers within their port limits. The Thames, however, is practically continuously lined on both banks with tidal wharves and jetties for the accommodation of ocean-going ships, from the Pool of London to Woolwich, while there is continual building of new jetties and wharves at various places from Woolwich down river as far as Gravesend, Shell Haven and Hole Haven.

These accommodations are owned by private wharfingers more or less in competition with the Port of London Authority which administers the docks and navigation of the river, and it is probable that the total amount of merchandise dealt with and stored at these jetties and wharves equals that in the Authority's warehouses in the docks.

It is not the purpose of this article to discuss the relative merits of tidal accommodation and enclosed docks; sufficient to say that apart from the heavy outlay entailed in the construction of an enclosed dock system, there are the continuous maintenance charges and working expenses in connection with the locks, lock gates, impounding pump stations, and so on; likewise interest, depreciation and technical supervision. There are also the unavoidable delays occasioned to shipping in passing through such dock systems.

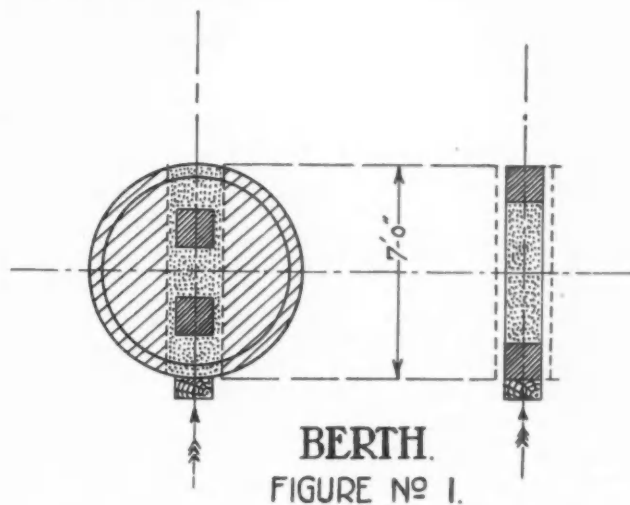
In those ports favoured with small ranges of tide, natural deep water and the physical features of naturally enclosed harbours, shipping enters and leaves at all hours regardless of tide, discharging or loading either fully or part cargoes, with no loss of time entailed.

An attempt on the part of the Port of London Authority to institute deep-water jetties to secure some of the advantages of tidal docks was recently made at Tilbury where a deep-water jetty, parallel with the shore, 1,000-ft. long and 50-ft. wide, with two decks, was constructed. The upper deck carries the cranes and railway trucks, the lower one being enclosed in the nature of a transit shed with hatches in the deck, and loopholes on the landward side.

The front of the jetty provides berthage for ships, and was dredged out to secure a depth of water of 30-ft. at the lowest state of the tide, while barges are accommodated on the landward side of the jetty.

It was thought, having regard to the fact that many ships come into the Port of London with part cargoes, that if a vessel could come alongside and discharge that part of her cargo consigned to London without waiting for docking, she would be able to proceed on her journey with much less loss of time than if she had to enter one of the docks. Several hundred tons of cargo could be discharged into the "transit shed" or lower deck which could subsequently be dealt with by means of barges and lighters for distribution, or the cargo could, if necessary, be loaded direct from the vessel into either lighters or railway trucks for distribution.

This jetty lies in a somewhat exposed position, and there is considerable velocity of tide in the vicinity, but it is understood that no difficulty has been experienced either in berthing, unberthing or mooring the vessels accommodated, which have been up to 20,000 tons.



The types of cargo that jetties in tidal waters seem to be especially suitable for are handling coal, oil, cement, and those other commodities which are usually shipped in bulk or in barrels, casks, sacks, cases, and so on, and which do not necessarily require accommodation in transit sheds within a few feet of the jetty.

There appear to be two disadvantages, apart from berthing risks, attaching to the use of tidal jetties where the range of tide is more than a few feet, i.e.,

(i.) The necessity of attention being continuously bestowed upon the moorings of the vessels to accommodate the rise and fall of tide;

(ii.) The varying angle of gangways, shoots and conveyors which may be used for discharging or loading portions of the cargoes.

These difficulties cannot be eliminated, but can, with ingenuity, be greatly minimised.

TYPES OF CONSTRUCTION, DESIGN, ETC.

The types of jetty to be adopted in a given situation depends primarily upon the purpose for which it is to be employed.

The majority of jetties are used for the discharge and loading of general cargoes, but many jetties are constructed for handling bulk cargoes—coal, cement, paper and oil. All jetties for such purposes, other than for oil, are therefore usually built somewhere about the length of the vessels to be accommodated in order that all hatches may be worked together. Such jetties must be built with ample deck space, and must be of adequate strength to sustain the heavy deck loads due to cranes and the stacking of cargo, and possibly the accommodation of railway rolling stock.

Jetties for the discharge of oil in bulk, on the other hand, actually require only sufficient length to accommodate the oil pipe lines which are connected to the vessel for discharge of the cargo, and little actual deck space. Many jetties for oil-discharging have been built with quite short tee heads, dolphins being provided at each end, of a distance apart about the length of the oil tankers accommodated, for berthing and mooring purposes.

The draft of vessel to be accommodated has also a considerable bearing upon the type of structure to be adopted; while considerations, such as depth of water available, rise and fall of tide, velocity of current, nature of ground composing

the river bed, slope of bed of river, depth at which firm ground is reached, time available for building and extent of periods of low water, all have an influence upon the question of design, affecting more particularly the type of construction rather than the type of structure.

There are two main principles upon which jetties are constructed irrespective of the purpose for which the jetty is required—

- (a) Open piling.
- (b) Cylinder construction.

The open-piled structure may be composed of timber, cast iron, steel or concrete, and the cylinders may be either cast iron, steel or concrete.

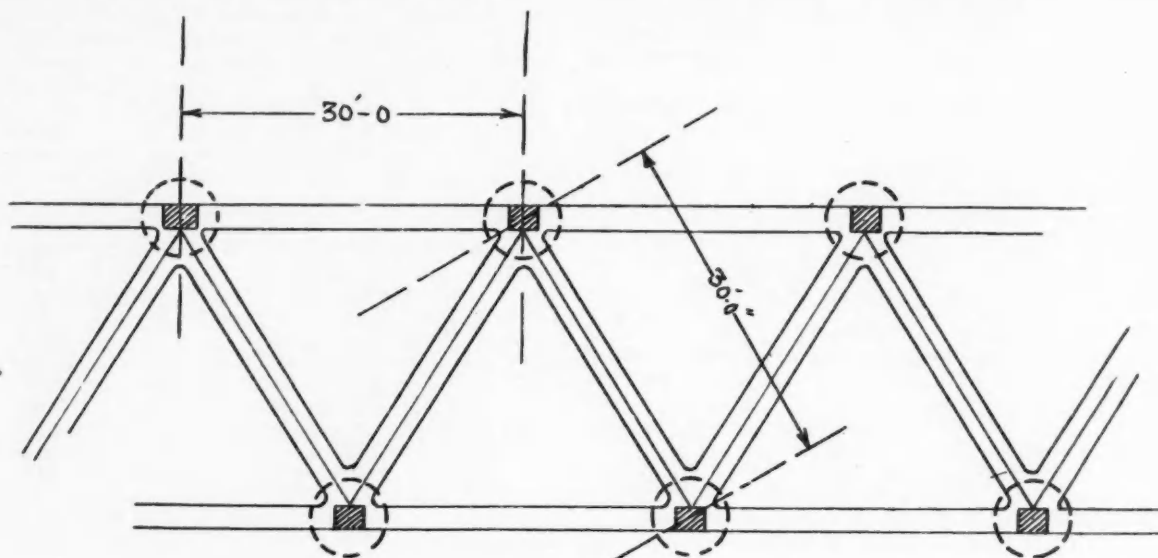
No definite policy appears to prevail as to which type should be adopted for a given purpose or situation.

Broadly speaking, however, a jetty for the accommodation of large vessels must necessarily be of a more robust and massive type of construction in order to withstand the heavy shocks and strains, and to avoid the danger of injury when the vessels are berthed. For this reason, in many ports such jetties are found constructed on the cylinder principle, either cast iron, steel or concrete, the latter nowadays prevailing.

In considering the question of open-piled versus cylinder construction for use in the construction of a proposed jetty, it

Mr. Ernest Latham, M.Inst.C.E., in an article in the *Dock and Harbour Authority* of July, 1923, suggests—if it is agreed that the principal value of the cylinder construction lies in its resistance to bending stresses—that the distribution of the concrete in the cylinders of present-day design is very uneconomical.

He states "It is now common practice to surround two piles with a concrete cylinder, but as the bending stresses normally only occur in the direction of the arrow (see Fig. No. 1), the shaded portions of the concrete cylinder section represent very unscientific distribution of material. Two similar piles with a total depth measured from river face no greater than that offered by the aforesaid concrete cylinder, therefore, offer no greater obstruction to the flow of the tide, or cause greatest scour. There seems no reason why suitable moulds should not be provided on the side of these twin piles to allow the rectangular space between them to be filled in with mass concrete. If desired, reinforcing bars could be left projecting on the inner side of the piles, to provide a sound bond with the filling, and the loss of sheer strength could be made good by such additional reinforcement as might be deemed necessary, though it is probably doubtful if such additional reinforcement would in practice be required. Some objection may be raised that the stream lines of the tidal flow would be interfered with,



BERTH.

FIGURE NO 2.

is necessary to take into account the situation of the jetty geographically.

Rivers, estuaries, harbours and coasts in this country are subject to variable weather, with fog in the winter months, and to tidal currents of considerable variation and magnitude.

Jetties along shores facing the direction of heavy winter gales will be subject to considerable impact beyond that experienced in sheltered situations in the upper reaches of rivers and in harbours.

Jetties in harbours and estuaries of rivers will usually be needed to accommodate larger vessels and, in such situations, it would appear that the stiffer and more robust cylinder-type of construction is particularly applicable as more effectually resisting the heavy impact stresses due not only to berthing ships, but to collisions in foggy weather.

The cylindrical type of construction is therefore steadily increasing in favour both in this country and abroad for all but the lightest of jetties, and is principally carried out in concrete.

Concerning the concrete structure, there appear to be three main considerations wherein lie the value of the cylinder construction.

Firstly, there is the much greater resistance to local bending stresses due to lateral blows and pressure from shipping—in the same manner as the face of a timber jetty is stiffened by double piles driven either close together, or spaced apart. Secondly, the inertia of the large amount of concrete in the cylinders is of value when ships are berthed; while the additional weight of the concrete filled cylinders helps to resist the tendency of the face piles to "draw."

Thirdly, the cylinders and concrete filling form a considerable protection to the reinforced concrete piles inside, which in ordinary reinforced piled jetties are liable to have the concrete cracked or even displaced by the impact of ships whereby the reinforcement becomes in time corroded or laid bare at once.

The real superiority of the cylinder type of structure would appear to be contained in the first consideration.

but if proper cut-waters were provided at the upstream and downstream ends of each row of columns, such interference would be negligible."

The suggestion quoted appears to be quite reasonable in the case of jetties of such size, and for such purposes, as to need only two piles in the cylinders, but in the case of cylinders composed of four or more piles, the uneconomical distribution of concrete is not so apparent.

The design of jetties composed of open piling or cylinder construction shows considerable variation in respect to the arrangement of the braces and walings, suggesting in many instances that quite different views as to their functions have been held by the designers.

A jetty for the handling of cargo has primarily to sustain the deck loads, and loads due to cranes, besides the dead loads of the structure itself. Secondly, it has to resist lateral loads due to shipping, the greatest probably occurring when ships are berthed, while the lateral loads due to wind on a ship of large dimensions are not inconsiderable, especially in exposed situations.

Wind, of course, may in turn blow off shore, in which case the load on the mooring ropes and the bollards is increased.

The action of waves in very exposed positions is again not inconsiderable, and requires consideration.

The lateral loads in almost all cases are likely to over-ride the vertical loads as regards importance, and therefore require the most careful regard to providing a jetty stiff enough to successfully withstand these loads and stresses for all time. In the case of reinforced concrete jetties, it is absolutely essential to eliminate all local bending of members to ensure long life for the structure.

Regarding lateral forces, it seems reasonable to consider the frames which compose a normal type of jetty to be vertical cantilevers embedded in the ground at their base, and likely to be subjected in tidal waters to lateral loads due to shipping at various heights therefrom, owing to rise and fall of tide.

From this aspect of the case, it appears quite evident that all piling should be concentrated towards the front and back of the jetty; that is to say, remote from the neutral axis of the cantilever, also that the bracing of the piles should be strongest towards the bottom—the fixed end of the cantilever.

The front piles of a jetty under loads due to shipping are clearly in tension, and there is a tendency to "draw," while the rear piles are in compression. Consequently "penetration" in the front piles is of importance, while "set" is equally of importance in the rear piles.

The stresses due to wind off shore on the ships lying at the jetty are, of course, the reverse of the above, but likely to be less in magnitude.

Considering many examples of jetties constructed, it seems obvious how often much of the value of the piling is wasted by being placed in the neighbourhood of the neutral axis of the structure. Sufficient piles only should be placed there as will sustain the super-imposed deck loads.

Under water work is, of course, costly seeing that it has to be undertaken by divers, but there is no doubt of its efficiency in producing a very stiff structure, the most effective bracing panels for resisting deformation being the lowest ones.

In timber structures, struts are of much more value than ties, provided they are properly seated at the ends and thrust directly against transverse or horizontal timbers. Ties depend entirely upon the bolts at the ends connecting them to the piles, in which there is much flexibility.

Mr. E. Latham in the article in the *Dock and Harbour Authority* previously referred to described a type of construction of reinforced concrete jetty which is somewhat interesting, and appears to be well considered. The type is also described in a paper read by him before The Institution of Civil Engineers on 13th December, 1921.

Fig. No. 2 shows the ground plan of piling or cylinders in one or more rows. Here the piles, instead of being opposite to each other in their respective rows, are staggered, i.e., the piles in the rear row are facing the centres of the bays of the front row.

The structure where this type of construction has been carried out is No. 6 Jetty, Shell Haven, for the London and Thames Haven Oil Wharves, Ltd.

This type of construction is, of course, only suitable to reinforced concrete owing to the excessive amount of cutting and fitting which would be required in timber structures carried out on this principle.

Mr. Latham points out that in the ordinary type of construction in timber or reinforced concrete, when impact occurs from a ship, a direct shear stress is thrown upon all the piles in line, as the horizontal walings act as strong struts, and the rear piles fail under shear before the walings bend. This difficulty is entirely eliminated when reinforced concrete is adopted and designed, as suggested in Fig. 2, it being possible, both in plan and elevation, to provide a simple triangular framework in the design.

It is stated by Mr. Latham that the real value of distributing the vertical supports in the manner indicated lies in the fact that, in the event of excessive lateral stresses occurring due to impact of shipping, the horizontal members are not put under direct compression, but are subjected to a definite bending moment; the obvious result being that failure first takes place in the fracture of these members, which tends to isolate the area affected by collision, instead of transmitting the shock to other vertical supports in rear, thus making the damage caused by any given impact of lesser extent.

OPEN-PILED JETTIES. GENERALLY CONSIDERED.

At the present time, probably the majority of jetties constructed in tidal waters of the rivers of Great Britain are composed of timber piles, while in waters which are brackish or salt there appears to be a marked tendency to substitute reinforced concrete piles with pre-cast bracing and super-structure, now that the deterioration of concrete and the methods of prevention are better understood, and the use of concrete is therefore increasing in most situations.

Cast-iron screw pile construction with wrought structural iron bracing and timber decking have been much favoured in the past, but now are seldom seen except in tropical waters abroad, and in this country in piers at watering places around the coasts—principally on account of the ease with which it can be constructed in the open sea, an advantage which is not apparent with the use of reinforced concrete or cylinder construction, and again on account of its ornamental character. With the latter type of jetty or pier we are not, however, concerned.

With regard to the choice of timber or concrete for jetties of small dimensions, there seems to be considerable difference of opinion as to the suitability and the respective merits of these two materials of construction. The use, however, of reinforced concrete for large jetties—especially those in salt or brackish waters, as has been pointed out—is fairly well established, but, in this case, those intended for the accommodation of the largest cargo vessels are mostly constructed of the cylinder type, and not of the open piled type.

There is no doubt that open piled structures of timber possess far more elasticity and resilience than those constructed of re-

inforced concrete piles and bracing. A timber jetty will deform considerably under the stresses of impact and pressure due to ships berthing, and will return to its original shape without apparent damage simply owing to the elasticity of the materials and that of the joints. Movements up to 3-in. appear to be quite common in even well-designed structures, and have been known to reach 12-in. without damage, but an excess of movement may be taken as indicating faulty design and is to be deprecated.

A reinforced concrete jetty of similar scantlings to a timber jetty will itself be stiffer, but it must be constructed to be doubly so or will suffer considerably from the consequences of impact during berthing operations.

No concrete jetty will stand deformation repeatedly for any length of time; sooner or later hair cracks will occur which in time may develop into cracks sufficiently large to admit water and air to the steel reinforcement, and so cause corrosion, swelling of the metal, and disintegration of the concrete.

In the construction of reinforced concrete jetties, there are certain practical considerations which require care—that is to say, in handling the pre-cast members, and care in driving the piles, to prevent initial cracks in the concrete. An adequate and well thought out system of fendering is, in addition, a *sine qua non*.

Considering cost of construction in timber or reinforced concrete, the advantages are somewhat on the side of timber, this having the additional advantage of the rapidity with which timber jetties can be erected compared with reinforced concrete jetties.

As regards maintenance costs, timber in many countries abroad has a very short life, while in this country a period of from 15 to 20 years may be considered the limit, after which time it may become necessary to carry out extensive renewals.

Many structures, it is admitted, have needed renewals on a large scale before these limits of time have been reached, probably owing to the neglect to set aside a sum for yearly maintenance, and to inspect and carry out ordinary periodical repairs, tarring, etc.

Provided the timber used in construction is good to start with, such periodical overhauls add considerably to the life of a timber jetty.

On the other hand, it must be at once conceded that, properly constructed, reinforced concrete jetties require little or no maintenance.

There remains the question of damage due to collisions.

It is claimed by many that timber jetties are less liable to damage, and, when damaged, are much more easily repaired.

From the point of view of the time required for repairs, this is undoubtedly true, and the time factor is likely in most cases to be of the utmost importance, especially where the damage has put out of action the whole, or a great part, of the jetty.

The cost of repairs is probably about the same for each material, and it has been said by the adherents of concrete that the difficulty of executing repairs in the case of reinforced concrete jetties is not so great as might be imagined, mainly to the fact that the members can be easily re-made, patched and united to the undamaged portions of the structure. There is in any case usually less necessity for drawing the stumps of broken piles and disconnecting a great many undamaged members in order to place and fix the new work.

It is undoubtedly the fact that the greater the safe "spring" or resilience of the structure, the less the damage. Reinforced concrete structures composed of piles, or cylinders, do not adapt themselves readily to stresses of this nature without serious fracture and disintegration.

It is again maintained by the adherents of concrete that actual damage by collision in the case of reinforced concrete jetties is usually confined to a much smaller area. This may be so, but it is in many cases extremely difficult for the engineer to determine the exact and extreme limits of the damage; in other words, to determine how far the ultimate strength or durability of the structure has been affected, and to what extent such impaired members should be cut out and replaced. Cracks in the concrete, although invisible to the eye, may be the cause eventually of producing disintegration of the concrete.

No mention has yet been made of the deterioration of reinforced concrete in water.

When jetties were first constructed in reinforced concrete, the general design followed that of similar structures built of timber, and it was supposed at the outset that such structure would be practically permanent.

It has, however, been abundantly proved that these early structures have been seriously affected by the action of water, especially sea water.

Experience of reinforced concrete structures for marine purposes now extends over something like 20 years, and of late years considerable research has been carried out with a view to ascertaining the causes and devising the best means of preventing occurrence of deterioration in the future.

The subject of deterioration and preventive measures is too broad a one to include in the present article; sufficient here to say that provided the concrete is composed, mixed and handled according to the best standards laid down, there is no reason why structures so constructed should not, apart from damages caused by impact and collision, be practically permanent.

Summing up, it may be stated that reinforced concrete open-piled structures can be adopted for marine work under most conditions of site and use, and generally with economy in first cost and maintenance, in comparison with other materials.

Experience has taught engineers where to realise the utility and economy of reinforced concrete open-piled jetties, and where to appreciate the limitations of this form of construction.

In the upper reaches of rivers and in sheltered situations in harbours and docks, there is no reason why the use of reinforced concrete should not entirely supersede the use of timber in open-piled jetties.

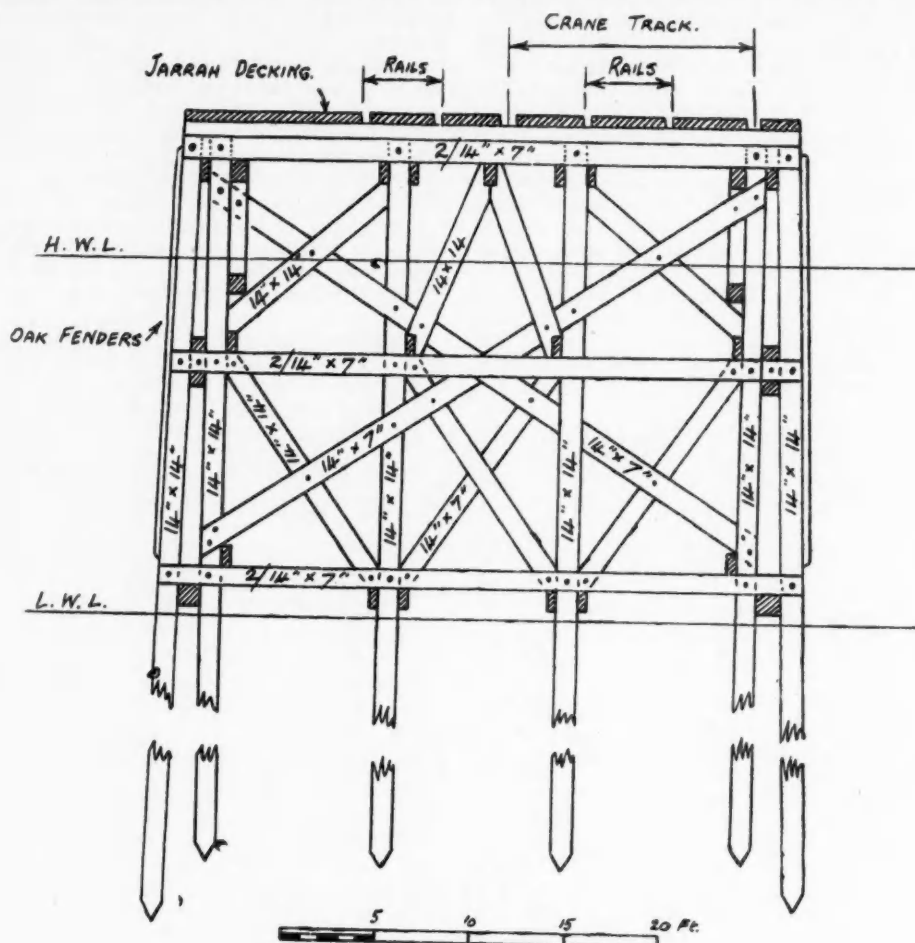
There are, of course, places abroad where an abundant supply of timber of suitable size and quality is obtainable, and where the high cost of labour would make the use of reinforced con-

Again, it is necessary to avoid joints anywhere where impact from shipping is likely to occur and cause local bending.

When the South Breakwater of the Admiralty Harbour at Dover was under construction in 1906, a failure occurred in the south timber gantry at the level of scarfed joints, as the result of a ship colliding with the structure; the scarfing plates buckled, and a considerable portion of the gantry was destroyed.

Practically, however, the piles of most timber jetties have to be scarfed just above low water level after about 15 to 20 years of life, or else entirely replaced, so that these theoretical considerations lose somewhat of the significance in practice.

The greatest essential appears to be that for a driven jointed pile, the scarf or butt joint must be very carefully designed and



TYPICAL TIMBER JETTY
CROSS SECTION OF HEAD

FIGURE NO 3.

crete appear to be prohibitive; but here again the latter material has the advantage of considerably longer life and economy in maintenance, which factor must be considered in arriving at a conclusion.

TIMBER JETTIES.

Pitch pine is undoubtedly the best timber to use in timber jetties, but for jetties in deep water difficulty occurs in obtaining the requisite lengths, recourse being had in many situations to Oregon Pine and Tasmanian Blue Gum, which are said to be obtainable in lengths up to 82-ft. by 20-in. square.

If these timbers are not favoured either on account of their not being so dependable as pitch pine, or for other reasons, recourse must be had to jointing pitch pine piles.

There appears to be much diversity of opinion as to the best position for such joints, scarfs or butts, some favouring the joint at the lower end, well buried in the ground, and others preferring that the joint is made above low water line where it can be seen and inspected.

Theoretically, it would seem that the best position for the scarf is as near either the top or bottom of the pile as possible and, if the latter, arranged to clear the bracing, because considering each frame at right angles to the face of the jetty as a cantilever loaded with the pressure or blows from ships alongside, the point of maximum bending is at or about the river bed level, and it is therefore theoretically essential to avoid joints at this point.

constructed, and driven down so as to prevent all possibility of the access of air to the iron or steel fish plates and bolts.

Mr. Ernest Latham, M.Inst.C.E., in his paper on "Deep Water Quays," read before the Institution of Civil Engineers in 1921, states that owing to the War it was then almost impossible to obtain either Oregon or pitch pine piles in single lengths for the purpose of deep water jetty construction, and that several hundred Oregon pine piles over 70-ft. long were driven. All piles were butt jointed and fished at the joints with 1-in. thick mild steel plates 8-ft. long, one plate on each face, the piles being driven with the shorter section forming the lower end of the pile.

The piles were driven to a set of 1/16th-in. with a 2-ton ram, having a drop of 2-ft. 6-in., as they had to carry heavy loads. There was no instance of failure.

Another method of jointing long piles mentioned by Sir Francis Spring was to butt end—not to scarf—such piles, fishing them by means of 15-ft. lengths of double-headed rails, laid flat along on four sides, and bolted through the webs with two or three bolts above, and the same below, the butt joint. Piles so jointed, it is stated, could be driven without risk of shivering at the joint. He had jointed long, heavy, reinforced concrete piles in a similar manner, the bolt holes having previously been left when the piles were being cast.

Fig. No. 3 shows the cross-section of a typical timber jetty head of good design for the accommodation of vessels of con-

siderable size. The jetty carries a crane track and two lines of railway. The decking is of 12-in. diagonal planking, covered with jarrah wood paving. All piles are 14-in. by 14-in. and the bracing is of a very substantial character, struts being of 14-in. by 14-in. timbers well seated and ties of 14-in. by 7-in.

This illustration is taken from Major Du Plat Taylor's recent book entitled *Docks, Wharves and Piers*.

REINFORCED CONCRETE PILED JETTIES.

The general design of this type of jetty in regard to bracing closely follows that of the timber jetty, but here all similarity ends.

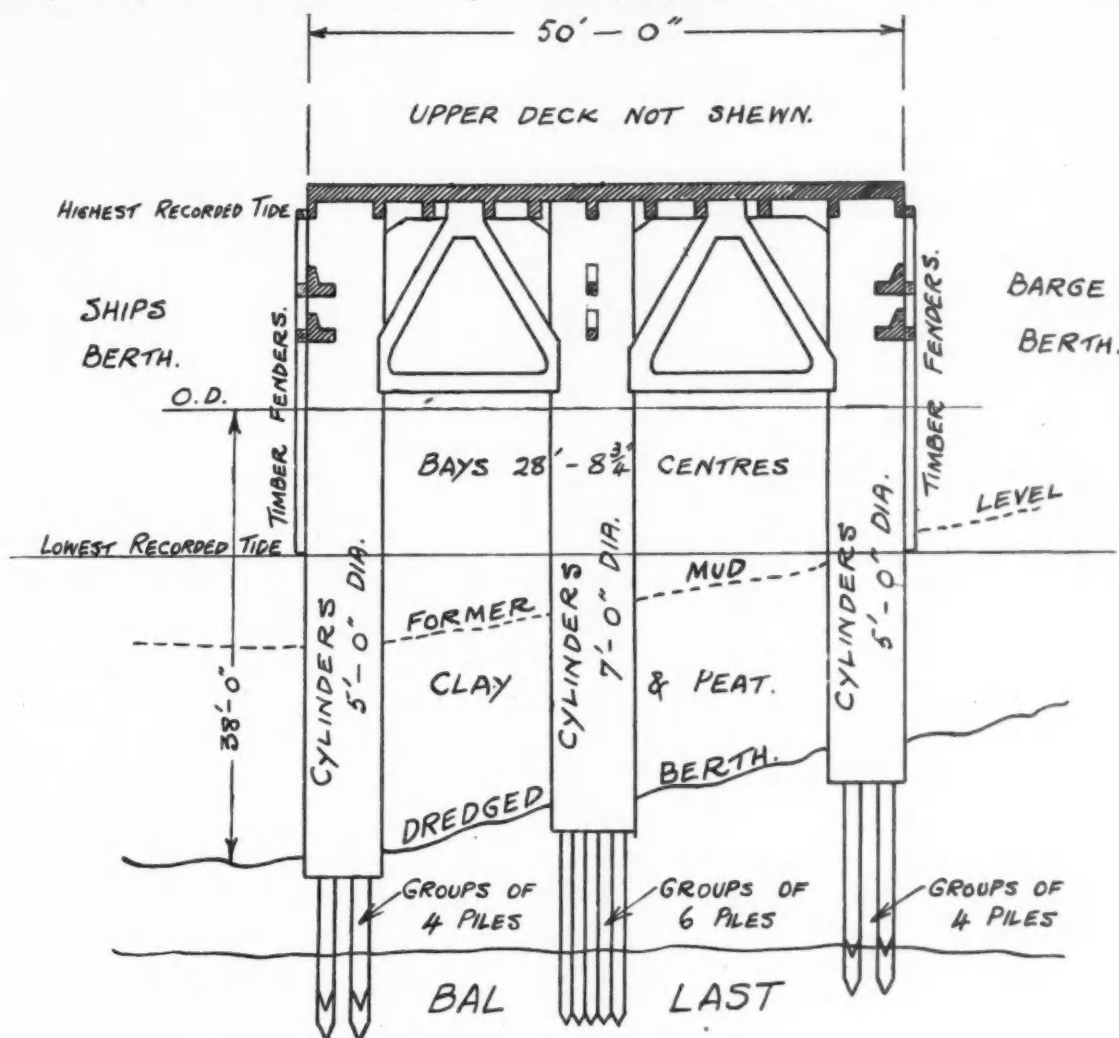
The degree of skilled supervision necessary to satisfactorily carry out a reinforced concrete job is very largely increased. The most unpromising labour can be trained effectually for the

to the reinforcement. The weight of the monkey and its fall must be carefully proportioned to the behaviour of the pile, and the head must at all times be efficiently protected.

The importance of using the utmost care in lifting and handling the piles when made, and when pitching, does not appear to have always received the attention it deserves. It is very necessary for the reason given previously, i.e., the bending movements set up when hoisting are sufficient in longish piles to cause the formation of hair cracks, ultimately with the most unfortunate results.

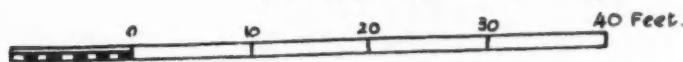
The bracing of the piled structure may be either pre-cast and matured ashore, or cast in situ; construction is carried out very largely by the former method, which has certainly much to recommend it.

In this case the same care as to handling the members should be exercised.



CROSS SECTION OF CARGO JETTY TILBURY

FIGURE NO 4



work, but all processes must be closely supervised by men both competent and conscientious.

As in all other reinforced concrete work, the importance of efficient supervision cannot be too highly stressed.

Not the least important part of the work is that of driving the piles to the requisite penetration and "set." In contract work, the contractors, whoever they may be, appear frequently to be unable to avoid some employees who are not perhaps too conscientious. It is therefore necessary to have the pile-driving carefully supervised by the engineer, particularly in cases where the set is the more important for foundation work.

The greatest care in driving reinforced concrete piles is necessary when severe driving through hard strata is required in order to obtain a given depth, and again when nearing the end of the driving and obtained the "set."

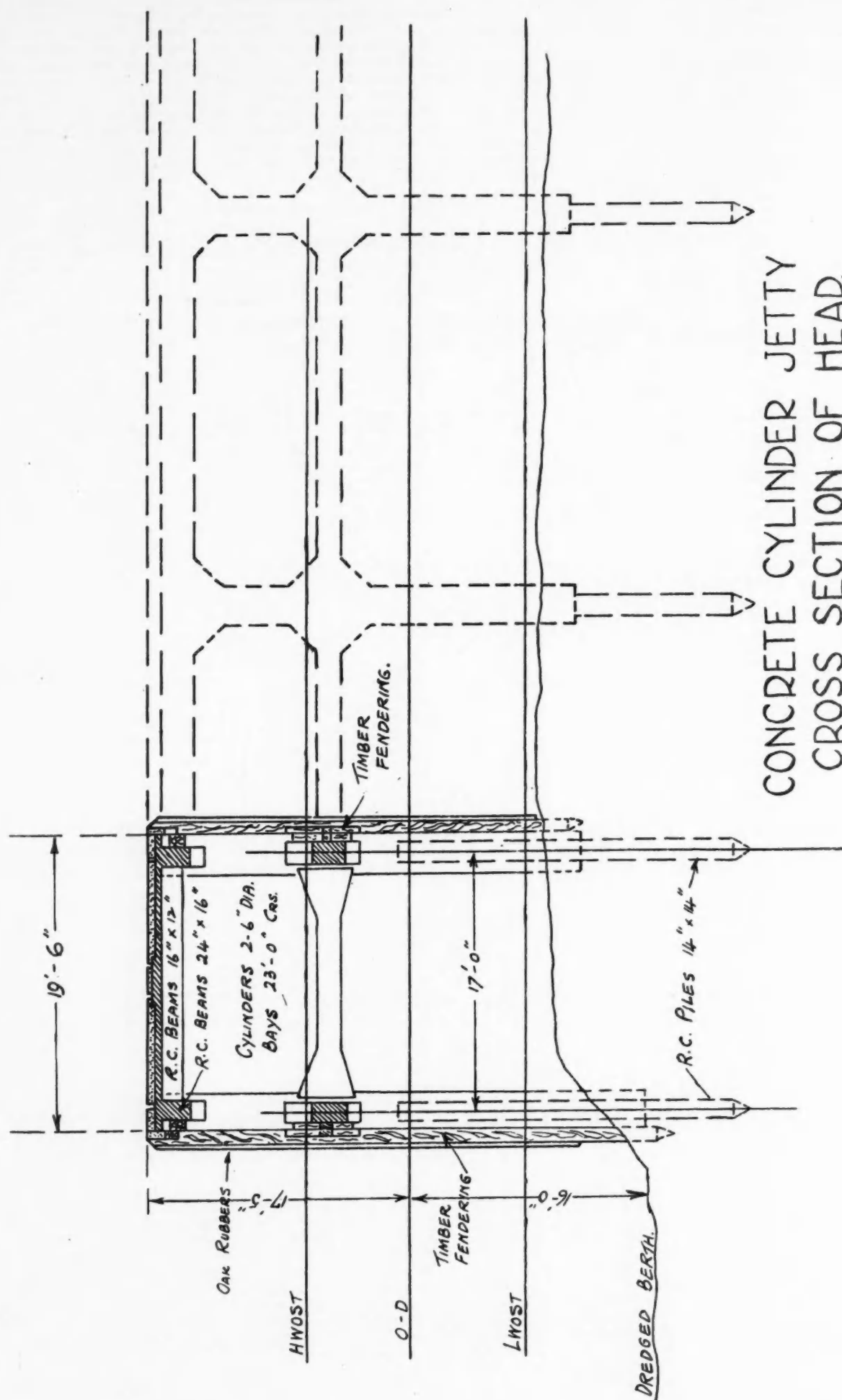
Piles carelessly or over-driven will develop cracks, even if the outer concrete is not noticeably damaged, which as has been noted, is sufficient to cause percolation of water and air

Piles are usually made 14-in. by 14-in., and 16-in. by 16-in., and various types of reinforcement are adopted. There are, of course, many patented types, each being recommended by the patentees on the grounds of some special advantage.

As regards mixture of concrete, there is much difference of opinion. Proportions of 1 cement to $3\frac{1}{2}$ aggregate seem to be now largely used, but a mixture of 1: 1: 2 has been recommended. Mr. Geo. Nicholson, Harbour Engineer at the Port of Los Angeles, gives 1: $1\frac{1}{2}$: 3 as the mixture used at that port for reinforced concrete piles which are subsequently heat treated with asphalt in much the same way as timber is creosoted. In this case, the outer 2-in. of concrete is deposited in a rather drier state than the body of the pile.

Another mixture is given by Mr. S. H. Ellis as 1 cement, $1\frac{1}{2}$ sand, $3\frac{1}{2}$ stone for piles, all pre-cast work and that laid in situ above water line.

This proportion, if correctly mixed, it is stated, will fill all interstices with a slight margin. Concrete too rich in cement



CONCRETE CYLINDER JETTY
CROSS SECTION OF HEAD.

FIGURE No 5.

is likely to develop contraction cracks, and an excess of sand forms a porous concrete.

SCREW PILED JETTIES.

Iron screw piled jetties form a suitable construction in any situation where the bed of the river is composed of silt or sand of unknown depth, and the piles will therefore depend largely upon skin friction for their stability or bearing capacity.

This form of construction is well suited to rivers in tropical waters abroad where no great depth of water is required, principally on account of the ease of erection (all parts can be sent out marked ready), no great expense being incurred for the provision of plant. The screw piles can be screwed down by hand by means of a capstan mounted upon light staging.

Considerable care is necessary to pitch the piles in their exact positions, and where the bed of the river is sloping, holes can with advantage be excavated by a diver for the blades of the screw. If the piles are much out of position, the greatest difficulty will be experienced in fitting and fixing the steelwork bracing and super-structure. For this reason, it is usually considered good practice to adopt round bar bracings with right and left-hand threaded screw couplings so that small variations in dimensions can be rectified.

Another method is to use a circular steel centre for the bracing bars, each bar being tightened up by means of nuts.

The problem of maintenance of steel piled jetties in brackish, salt waters and tropical rivers is somewhat expensive, periodical scraping and tarring of the members above low water line being essential.

Mr. Somers H. Ellis, M.Inst.C.E., in an article in this journal states that in tropical waters he found it best to scrape completely and paint once a year all members above low water line, using ship bottom paint, one coat anti-corrosive and one coat anti-fouling from low water line to high water neap tides, and above high water neap tides one coat of red lead and one coat of tar. He found various bitumastic paints successful, provided the steelwork was perfectly dry on application.

CYLINDER JETTIES OF CONCRETE.

As has been pointed out, the cylinders may either be in the form of caissons sunk to a hard strata and then filled with concrete, or merely in the nature of casings around groups of piles and which are then filled with concrete.

In the latter form of construction, unless the casings are also sunk down to a hard strata of some thickness, the concrete piles must be assumed to carry all the deck loading of the jetty and, in addition, the weight of the surrounding mass concrete and casings.

In the caisson method of construction, piles are not generally used at all for any purpose.

In the River Thames, there are many examples of each type, the latter type predominating in the reaches of the river between Barking and London Bridge where a depth of water at low water ordinary tides of some 15-ft. is readily obtained, and where a good ballast foundation is reached generally at a reasonable depth below Ordnance Datum.

Below Barking and beyond Gravesend, where there is a much greater depth of water, and where the depth at which a good bearing strata is found varies between wide limits, the piled form of cylinder construction is more often met with.

The caisson form of construction, using concrete cylinders, are usually sunk by the grab method until the cylinders rest in their correct positions. Concrete is then placed with great care, it being essential to avoid dropping it from an excessive height, otherwise the ingredients tend to separate to the detriment of the resulting structure.

In the piled cylinder construction, there appear to be three methods followed, each of which give good results, as follows:

(a) First driving the piles and then placing pre-cast cylinders over them.

(b) First driving the piles and then placing the concrete around them using temporary sheet steel moulds.

(c) Pre-casting the cylinders, pitching them in position on the river bed, and sinking them to the required depth by weighting and grabbing out the interior, and then driving the piles within the cylinders.

Methods (a) and (b) would appear to be the more generally adopted.

Method (c) was adopted by the Port of London Authority in the construction of the Cargo Jetty at Tilbury, which is the largest reinforced concrete jetty yet built in this country, for the accommodation of deep draught vessels.

In this case, the jetty—Fig. No. 4—consists at the lower end of three rows of cylinders, the outer ones being 5-ft. 6-in. diameter, and 4-in. thick, and the inner row 7-ft. diameter, and 5-in. in thickness. The segments and rings in each case were 4-ft. 6-in. long with socket and spigot joints, filled with bitumen. The lowest rings were provided with a cutting edge, making the lower edge of the cylinder 1½-in. larger in diameter than the body of the cylinder. The 5-ft. 6-in. cylinders contained four piles, 14-in. square of reinforced concrete, while the 7-ft. cylinders contained six similar piles.

The cylinders were spaced 22-ft. 8½-in. centres along the jetty. All the piles were driven down into the ballast, but the cylinders were only sunk to sufficient depth in the clay and peat

overlying the ballast to allow for the final dredging of the berth and settling down of the slope of the river bed to still provide a cover of several feet.

A special frame or cage composed of mild steel sections was employed to guide the piles when pitched and while driving. Mud adhering to the insides of the cylinders was washed away with a water jet, and the cylinders were then carefully filled with concrete, the upper portions of the cylinders being provided with reinforcement which was carried up into the bracings and beams.

The bracings were pre-cast triangular construction uniting the cylinders in adjacent rows and connected into the transverse beams above.

A large jetty for the accommodation of oil tankers was constructed at Thames Haven by the method (b).

This jetty consisted of two rows of cylinders about 5-ft. 6-in. diameter.

The opinion has been expressed that method (b) is preferable to the other methods, inasmuch as, if the moulds are struck, as they undoubtedly should be, on completion of the concrete surround work, any defects in placing the concrete will at once be revealed.

There appears to be a certain amount of truth in this argument, especially where the outer faces of the piles are in close proximity to the inner face of the cylinders, making it difficult to ensure that concrete accurately fills the spaces.

This, however, is a matter of design and can be avoided, while the driving of the piles can be carried out by means of a properly-constructed frame whichever method (a), (b) or (c) is used; so that they are pitched and driven in their correct positions, provided, of course, no obstructions are met with in the strata through and into which the piles are driven.

The proper method in (a), (b) or (c) of depositing the concrete is by tubes, and the best results are obtained when the process of depositing the concrete core is carried out uninterruptedly from the start to a maximum height above L.W.O.S.T.

Unless the cylinders are well sunk into the river bed, it appears advisable to ensure that the concrete as deposited does not leak away from under the lowest ring, by excavating and depositing concrete in bags around the cylinders.

Mr. Speight, in some correspondence on the paper before referred to entitled "Deep Water Quays" read before the Institution of Civil Engineers in December, 1921, described a method of depositing concrete in the cylinders of a jetty.

He states "the concrete should be deposited through a light steel water-tight tube fitted with a water-tight foot-valve operated from above, the top of the tube being fitted with a hopper into which the concrete can be fed rapidly; the tube to be of such length that when the foot-valve rested on the bottom of the cylinder concrete, it could be fed into the hopper above the level of the water.

The number of tubes used was governed by the size of the cylinder, the quantity of concrete to be placed, and the time available between tides. Suitable arrangements to be made for rapidly lifting and lowering the tube, which, at the commencement, should be raised so that the foot-valve is above the level of the water. The foot-valve should be opened to release any water from the tube, and then closed, after which the tube should be filled with rich semi-dry concrete. The tube, with hopper attached, is next lowered into the cylinder and allowed to rest upon the bottom, after which the valve is opened. The tube is then gently lifted a few inches at a time and the concrete flows away from the foot.

More material is then fed into the hopper at the top. The greatest care is necessary in the manipulation of the tube to prevent loss of the concrete "priming." The top of the concrete in the tube should be visible throughout.

If for any reason the charge in the tube is lost, the tube should be immediately withdrawn and recharged with the foot-valve above water level. The deposited concrete should be disturbed as little as possible, and ramming or tramping should not be resorted to.

When circumstances had necessitated the suspension of operations before reaching L.W.O.S.T., it had generally been found on subsequent examination that a crust had been formed varying in depth up to several inches over the area of the cylinder, consisting of a soft, greasy substance. This was probably due to cement rising from the concrete and mixing with suspended matter in the water, and then being deposited as a film over the top of the concrete. When that occurred, it had to be cleaned before commencing re-concreting.

It would be seen that the operations were comparatively costly, but where care was taken, success would be achieved and demonstrated on the removal of the temporary steel moulds (if used), when the face of the cylinder would present to the touch a smooth hard surface.

Fig. No. 5 shows a jetty of the concrete cylinder type constructed at Gravesend at Henleys Telegraph Works in the River Thames by L. G. Mouchel and Partners, Ltd. The cylinders are 2-ft. 6-in. diameter in 23-ft. bays, and contain single 14-in. by 14-in. reinforced concrete piles. The bracing is of pre-cast reinforced concrete.

The total extension of the jetty is about 200-ft., and the length of the tee head also about 200-ft. This system of con-

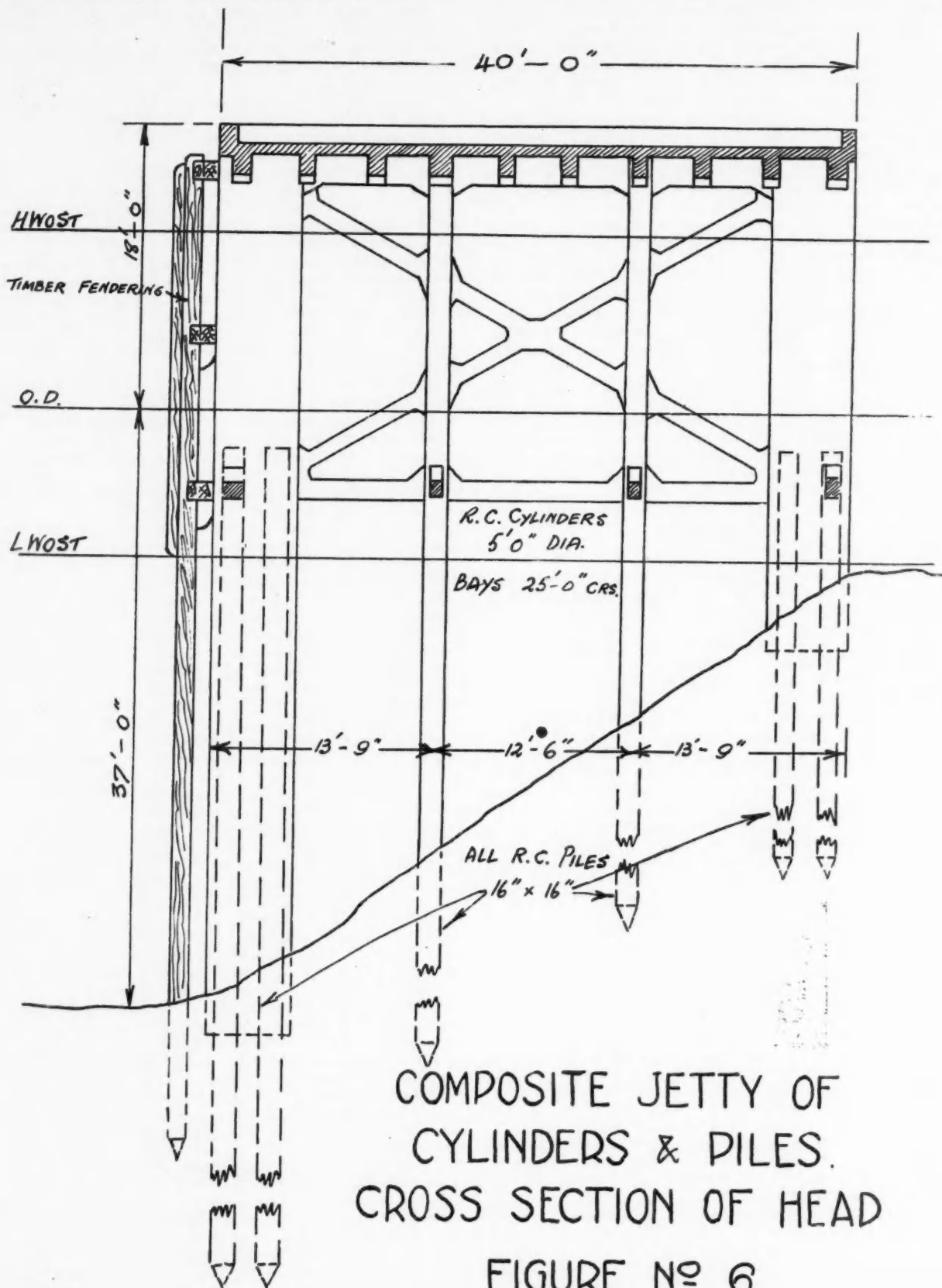
struction has, it is understood, been patented by Mr. L. G. Mouchel.

Fig. No. 6 shows a composite jetty, of cylinder and reinforced concrete pile construction. This structure was built for the Imperial Paper Mills, Ltd., at Gravesend, in the River Thames, by Messrs. Considere and Co., Ltd. The cylinder bays are 25-ft. centres, with piles between the cylinders. Intermediate frames

CYLINDER JETTIES OF IRON AND STEEL.

Caissons of cast iron cylinders were used almost exclusively for this type of cylinder construction until the advent of steel. Even now they are largely employed.

Cast iron cylinders are constructed, as a general rule, in lengths of from 5-ft. to 6-ft., and usually in one piece without vertical joints where the diameter does not exceed 10-ft.



in the cylinder bays are of 16-in. by 16-in. reinforced concrete piles at 6-ft. 3-in. on either side of the centre line of the head, braced to the front bracing connecting the cylinders. Each cylinder contains two reinforced concrete piles 16-in. by 16-in. square. The approach is of reinforced concrete open piling 40-ft. wide, composed of bays 30-ft., each group of piles containing 8 piles in pairs 4-ft. apart transversely and 12-ft. 6-in. centres across the approach. The tee head is braced horizontally as well as vertically.

A chalk foundation was reached, it is understood, at about 45-ft. below Ordnance Datum at the front cylinders. The chalk in this vicinity slopes up rapidly inshore, and accounts for the short cylinders on the inner face. The total extension of the jetty is 180-ft. and the length of the tee head 300-ft.

Making-up pieces of varying lengths are required to enable the correct height to be reached due to inequality of penetration of the cylinders into the hard strata and the settlement of the cylinder under the test load.

The diameter of the lower rings is determined by the vertical load which such cylinder has to carry, and the safe bearing capacity of the strata upon which they are to rest and the necessity for providing ample facilities and space for excavation if done by air lock. The upper rings are then usually reduced in diameter to save material, special taper pieces being provided for this purpose.

Cylinders of small diameter can be sunk by the same means as is adopted in sinking concrete cylinders, that is to say, by weighting and grabbing out the interior.

With regard to sinking cylinders of sufficient size for men to excavate and remove the material inside, the most usual method is, of course, by means of the compressed air system, and the use of the air lock.

In certain cases, however, where the strata is known by borings to be firm, tenacious and impervious to water, the sinking of cylinders can be carried out by loading and excavation without the use of compressed air.

The compressed air system is preferred in all cases where the nature of the soil is to any extent unknown, in order to safeguard the risk to human lives by a "blow" caused by sudden changes in the character of the strata passed through.

In certain instances, it has happened that the lower ring with the cutting edge has been broken or fractured, possibly owing to the forcing of the cylinder down through a hard unyielding strata, the meeting of obstacles such as boulders and the presence in the cast iron ring of initial stresses due during manufacture to unequal cooling of the iron when cast. For this reason some engineers have preferred to construct the lower or cutting ring of mild steel plate and structural sections. This practice has much to recommend it, where the nature of the soil is to any extent unknown or doubtful.

The Gas Light and Coke Co., Ltd., have recently extended one of their jetties at Beckton Gas Works on the River Thames with cast iron cylinders and steel bracings to carry a crane track for unloading coal by grab.

This work was done by weighting the cylinders and excavating the interior by the air lock principle.

FACILITIES FOR BERTHING AND MOORING SHIPS.

Vessels much over 6,000 tons deadweight should be provided with berths giving sufficient water to fully float the vessel at any state of the tide; they should never take the ground, otherwise serious trouble is likely to occur owing to inequalities in the bed of the berth causing straining, particularly when the strata is hard and unyielding, such as ballast.

In the case of berths on which ships rest, partially waterborne, at low water, there is difficulty in constructing and maintaining a satisfactory berth. With such berths it is necessary that periodical soundings be taken and any inequalities removed by some method. Bucket dredging is unsatisfactory as it is almost impossible to obtain a flat level berth by such means. The best way is by a small ladder dredger, carefully used, moved and adjusted by frequent observations on a tide-gauge.

A method suggested, where the use of a crane on the jetty can be obtained, is to sling a 30-ft. or 40-ft. rail from the crane horizontally and at right angles to the quay, and by the use of a bucket dredger, and also, if necessary, by divers, to remove any irregularity thereby revealed.

Undoubtedly the best course, where the strata is hard and unyielding, is to have the berth properly prepared in the first instance by dredging out the area, levelling it, and then placing sav 18-in. to 2-ft. of block salt upon it, this also being levelled.

It is understood that insurance companies will give ship-owners a reduced premium if their vessels are never put in a berth that has not been properly made and levelled.

In most cases, it is the general rule that the wharfinger has to provide a fair berth, and it cannot be too strongly emphasised that periodical sounding and probing should be carried out. The position of all soundings should be accurately recorded, as one of the main factors in the case of a damaged ship is its exact location on the berth. A very good plan, in addition, is to record the position occupied by each ship on the berth.

Damage to ships by taking the ground is very frequent, and, in the event of litigation, the foregoing facts are of the utmost importance.

Most jetties for the handling of cargoes other than oil and coal are at least equal to, or greater in length than, the ships berthing thereat, and in this case no particular difficulty occurs in berthing the vessels.

A type of jetty, of which there are many examples in the lower reaches of the River Thames, is the short tee-headed jetty with dolphins at each end. There seems to be a tendency, however, to abandon this type owing to there being no flexibility of position available for the vessels as there is in the case of the continuous or long-headed tee type. It has also been found that when berthing large vessels of from 15,000 to 20,000 tons deadweight, serious damage has occurred to the dolphins, some of which have been completely wrecked by heavy collisions when berthing in rough weather.

The destruction of a dolphin means in such types of jetty that the berthage is lost until such time as either it is repaired, or a temporary one driven.

It has been mentioned that tidal berths, where the range of tides exceeds 25-ft., become impracticable, and one of the reasons given was the difficulty of providing safe moorings. In a long line of quayage, or a long tee-headed jetty, the nautical difficulty of holding a ship in a tideway constantly varying in height presents a very real problem.

In the case of the Tilbury Cargo Jetty, which is 1,000-ft. long, the property of the Port of London Authority, cast iron mooring bollards were fitted along the front of the jetty, and to take the end moorings of ships when the railway track on the deck of the jetty was not in use, or for putting out additional

moorings at times of storms, eight steel rings were provided at the back of the jetty. When in use the moorings pass to these rings right across the jetty.

In addition, two sets of three sliding vertical moorings were provided. These consist of steel bars 6-in. diameter secured vertically to six of the cylinders, sliding rings being provided to which the ships' moorings could be made fast. This arrangement gives a certain amount of vertical movement, and consequent freedom from attention to moorings over a limited tidal range.

A very heavy single bollard was placed on the front of the approach viaduct some distance beyond the end of the main jetty, and at the opposite end a mooring buoy was provided attached to screw piles in the bed of the river. The end mooring ropes of ships are secured to these two devices to resist the pressure due to the action of the current parallel to the line of the jetty.

In the case of a jetty and dolphin combination, or a jetty equal to or less in length than the overall dimensions of the ships berthed, the bow and stern ropes can be carried ashore without interference to the working of the jetty, while the "springs" can be secured to bollards along the front of the jetty. This is a perfectly satisfactory method when it can be adopted.

Until engineering and nautical ingenuity evolves a satisfactory mooring system that may be safely left to look after itself, it appears evident that men must be employed day and night in most tidal waters of the British Isles to look after and alter the moorings as the tide rises and falls.

Bristol Channel.

Transport of Heavy Machinery by Barges.

A remarkable piece of transport work was carried out recently, says a "Clevedon Mercury" correspondent, when a culvert weighing about 70 tons was taken down the Bristol Avon from the Albion Dockyard of Messrs. Chas. Hill and Son, Ltd., to Portishead.

The culvert, taken from its flooded dry dock, left Cumberland Basin at mid-day, and was at its lock at Portishead not long after 3 o'clock. Too heavy to lift and take down to Portishead in the ordinary way the structure was slung from the bows of two barges fitted with special gear, the water taking off some of the weight. Towing was carried out with the barge astern first and the culvert crossways. The transport arrangements were in the hands of Messrs. T. R. Brown and Son.

The structure is one of the four similar culverts which are to serve as portals, or mouths, for four tunnels conveying circulating water to the new electrical power station at Portishead. The present state of the works is such that it is now possible to place one of these portals in position. Each structure, when submerged, will form a mouth to a tunnel nearly a quarter-of-a-mile in length, running through the rocks from the works to the water. The diameter of the tunnel is 7-ft. 6-in., and the portals are of the same size.

Each portal consists of a steel cylinder, lined with brickwork and granite facing. They are fitted at one end with massive hinged doors, which may be closed if at any time it is necessary to pump the culvert dry.

The culverts have been built in the Albion Dockyard for the contractors, Messrs. Bland and Son.

The first culvert was lowered into its trench on the Channel bed about half-a-mile distant from the Firefly buoy off Portishead.

The work occupied a morning and afternoon and the culvert was lowered from the barges by means of which it had been conveyed to Portishead. It was taken from its lock at Portishead in the morning, and after various measurements had been made it was finally lowered in the afternoon.

Several adjustments remain to be completed, and the structure has yet to be sealed to the particular tunnel of which it forms a portal. [Photographs appear on page 191.]

WESTERN ROUTE OF CANADA—WEST INDIES SERVICES TO BE INAUGURATED ON APRIL 13th.

R.M.S. "Lady Somers," Canadian National Steamships, will sail from Halifax, N.S., on April 13th next, the first of the new vessels to go into commission under the terms of the agreement by which Canada is to furnish a fortnightly passenger and freight service between Canadian ports and Bermuda, the Bahamas and Jamaica, R.M.S. "Lady Rodney," in the same service, will sail from Halifax on April 29th. Each steamer will complete the voyage at Montreal, and thereafter during the open season of navigation on the St. Lawrence these vessels will make the voyage from Montreal.

The "Lady Somers" and "Lady Rodney" are sister ships to the "Lady Nelson," "Lady Drake" and "Lady Hawkins" now in service on the eastern route. They will carry first-class passengers only and will have special refrigerating facilities for bananas, other fruits and vegetables, the banana space on the new 8,000-ton ships providing for carriage of 100,000 stems.

Bristol Channel.



Transporting a Culvert by means of Barges.

By courtesy of "Bristol Times and Mirror"



Another View.

[By courtesy of "Bristol Times and Mirror."

Port of Philadelphia, Pa., U.S.A.

Department of Wharves, Docks and Ferries.

The municipal authorities in charge of maintaining Philadelphia as second port in the United States have announced a distinct policy of extension and improvement. While it is planned to continue the extensive improvement of the Delaware River, the present administration of port affairs have undertaken the project of bulkheading the Schuylkill River, upon a very limited stretch of which stream within the City limits, one-third of the commerce of the Port of Philadelphia is annually carried.

These two streams are essential contributing factors in the shipment of cargo averaging annually 27,000,000 net tons and with a valuation of \$1,100,000,000. No other waterways in the country present the same commercial possibilities as these two. The value of the Delaware River to the people of Philadelphia, and the surrounding territory, and the many other communities located upon its historic banks, cannot be over-estimated. Some thought of its future may be gauged in the single fact that an improvement project authorised by Congress in 1910, and but recently consummated, must immediately be succeeded by a similar one of greater proportion. This is the completion of the 35-ft. channel from the sea to the City. There exists to-day the need for a channel of greater depth and width, one of 40-ft. on the centre line, and of greater width wherever possible. Deepening of the Schuylkill Channel to 35-ft. to correspond with that of the Delaware also awaits further action. The size and draft of ocean-going vessels constantly increases. With the deepening of the channel, the business of the port has doubled and it is most desirable that authorisation for the deeper channel be made as soon as possible. While the City of Philadelphia has spent approximately \$35,000,000 in great new piers, wonderful street approaches, modern facilities and a well-maintained river to accommodate the immense shipping interests which use the City's harbours, there is much more to do.

The trade annually on the Philadelphia water front runs into hundreds of millions of dollars and this must be provided with equipment which guarantees quick shipment, rapid handling and low charges. The immense value of the investments at this port requires adequate and efficient facilities and maintenance. The total amount of foreign trade of all kinds carried on, in and through Philadelphia each year, is approximately \$2,000,000,000. Of this amount, about \$500,000,000 is distinctly Philadelphia representation, and then there is about \$350,000,000 each year represented in the products going through the City. Large quantities of products are shipped through this port each year which come from New York, Baltimore, inland cities and points as far west as the Pacific Coast. A large part of the \$9,000,000,000 worth of manufacturers of Pennsylvania must be consumed either abroad or on the Pacific Coast and one of the surest methods of reaching the desired market, it has been found, is through the Port of Philadelphia. At our very door are manufactured two of the mightiest cargo producers of the future—steel and cement. South-eastern Pennsylvania, exclusive of the Bethlehem section, only 50 miles away, produces annually over 4,350,000 tons of pig iron and over 4,000,000 tons of steel ingots. The greatest American cement centre is within 50 miles. No further away is the Lehigh Valley steel industry, while the steel mills of the Schuylkill Valley are just outside of the City. Practically 100 per cent. of the anthracite coal produced in the United States comes from the State of Pennsylvania. Over one-third of the bituminous coal is also produced here. Anthracite mining is by far the most important mineral industry of the Third Federal Reserve district (the Philadelphia marketing area) and the total annual output of anthracite amounts to about 90,000,000 tons, valued at approximately \$488,700,000. Metropolitan Philadelphia consumes 5,500,000 tons of coal annually and the shipments of coal through the port aggregated 1,500,000 tons in 1927. The most extensive business of the Port of Philadelphia to-day is probably in the importation and exportation of oil. In 1927 a total of 3,013,070,311 gallons of oil were handled at the Port of Philadelphia and the business of the current year will greatly exceed this. The handling of oil, in gallons, has doubled in the past five years, and it is a matter of interest to know that at the time the 35-ft. channel project was authorised there was not in existence a tank steamship carrying in excess of 2,500,000 gallons of oil. To-day the modern tanker lifts much more, and, of course, requires for safe navigation a greater depth of channel. The world's largest Diesel electric tanker, the new motor ship "Brunswick," of the Atlantic Refining Company, arrived at the Port of Philadelphia on September 11th, from her builders yard, the Scott Shipbuilding and Engineering Company, Greenock, Scotland, under the Panamanian flag. The new ship, which is 469-ft. long, 63-ft. beam and 36.9-ft. deep, has a capacity of 4,500,000 gallons. Her deadweight tonnage is 13,200. She sailed September 14th with a full cargo of gasoline for London.

Philadelphia has always played a leading part in the development of American commerce. The port began trade with

China in 1785; with Argentina and Uruguay in 1798; with Australia in 1792, and with Brazil in 1800. To-day there are 50 or more steamship companies with scheduled sailings from the Port of Philadelphia, carrying goods to all parts of the earth. There arrived and departed in the year 1862 in the foreign and coastwise trade, vessels totalling 2,480,000 tons. The net tonnage of 12,086 vessels which arrived and cleared in 1927 was 26,448,544. Quoting comparative shipping is but a meagre means of adequately describing the expansion of Philadelphia's port. Behind these figures lies the fact that while the bulk of the trade at this port in 1909 was domestic, in 1920 and later, it had become largely foreign, and the immense tonnage had been converted from coastwise to export and import shipments. In this change in the destination of cargoes lies the unusual story of the ports developments. Philadelphia has done more in the last few years to realise the dreams of its earlier planners for international greatness than at any time in its history. There has developed a close competition between various ports for this foreign trade. On the East Coast Boston, New York, Philadelphia, Baltimore, Norfolk, and Charleston have been desirous of getting their share. On the Gulf there has been close competition between Mobile, New Orleans and Galveston, while on the west we find Portland, Seattle, San Francisco, Monterey and San Diego, all anxious to gain supremacy. To convince the shipping companies and the industrial leaders to locate within their ports means, of course, the necessity of offering inducements, and there are few inducements which appeal more to the shipping man than improved ports. The possibilities of the Delaware River began with its initial improvements many years ago when the Congress of the United States made provision for the betterment of channel conditions of the Delaware River. The first systematic effort began in 1885, and the project provided for a 26-ft. channel. This with subsequent improvements and the completion of the 35-ft. channel required expenditures of more than \$25,000,000. The Government's part has been accompanied by efforts of equal importance and magnitude on behalf of the municipality, the largest corporate interests and by many and far-reaching private interests. Consistent returns have been realised upon these investments. An enormous volume of commerce has been created, and this enables the port authorities to collect for the Federal treasury for the use of the nation annually an average of more than \$50,000,000 in customs and revenues. These amazing returns, upon the Government's investment for dredging and deepening the channel from 17-ft. (the original minimum depth) to the present 35-ft. stage at mean low water, are two-and-a-half times greater than they were when the channel was less than 30-ft. deep. The tonnage figures of the Delaware compare with any other river and justify the claim that it has become the greatest commerce-carrying river in the United States.

Manifest evidence of the willingness of the City of Philadelphia to build a modern port is found in a continuing plan of improvement and extension. Since the organisation of the Department of Wharves, Docks and Ferries in 1907, until the beginning of the present year there has been expended in the purchase of sites, the construction of piers, the building of bulkheads, the installation of a dredging plant and other facilities of the Port of Philadelphia, directly under the supervision of the department not a less amount than \$24,029,159. This, too, apart from the average sum of \$200,000 appropriated annually by Councils for the operation of the department, including the ice boats and dredging plant, and repairs to piers, bulkheads, etc. The opening and paving of the marginal street—Delaware Avenue—has provided the City with a means of ready access between the water front and every point of cargo delivery in the City. In the words of a recently-read article on this splendid highway:

"Trade and transportation rule every rod of Delaware Avenue."

The fact that in the year 1927 the sum of \$545,405.54 was collected and paid over to the Receiver of Taxes by the Department of Wharves, Docks and Ferries, this representing revenues from pier rentals and dredging payments, is not adequate evidence of the value of the City's investment in shipping facilities. The Municipal piers are self-sustaining and the advantages of establishing and maintaining modern harbour equipment reach much further in the up-building of the port and the community. It is the plan of the present administration to proceed with required betterments. Within the first six months of this year one of these major improvements has been started with every indication of early and successful completion. This is the bulkheading of the Schuylkill River, adjacent to that part where it meets the Delaware. Thirty per cent. of the commerce of the Port of Philadelphia is carried on this stream, yet it is narrow and shallow. It is planned to bulkhead six sections where bulkheads do not exist. This will maintain a channel that will accommodate the larger vessels, and will serve to reclaim a large area of lowlands adjacent to the river for maritime and commercial purposes. The Department of Wharves, Docks and Ferries has placed contracts for the bulkheading of two sections, these with an aggregate price of \$799,422.85, and covering a distance of more than 7,000-ft. on the west bank. The project plans the bulkheading of approximately 50,000-ft. upon both sides of the Schuylkill River.

Some of the largest of our industrial establishments are located on this stream and others are viewing sites with that thought in mind. Further plans of port extension cover the completion of the great Moyamensing Group of municipal piers on the Delaware. Two of the four planned are constructed, and in active use, forming with the adjacent Tidewater Terminal piers, built by the Government, a busy location on the City's water front. In due time two other piers of this Group, one at Wolf Street and a second at Jackson Street, will be made available for the use of shipping.

The policy of improving the water front has not been confined to the municipality. The facilities for loading grain at the Port of Philadelphia were greatly increased within the year by the completion of the Reading Railway Company's three-year marine terminal facility development programme at Port Richmond. This includes a 2,500,000 bushel grain elevator which now gives Philadelphia the largest plant of this kind on the Atlantic Coast. In connection with this elevator the Reading erected a new pier 722-ft. long, at which four ships may be loaded at one time, the elevator discharging 90,000 bushels of grain in one hour and loading the average grain-carrying vessel in four hours. This is a record nowhere possible at any exporting port in the world. For the quick dispatch in loading and unloading vessels at this pier, cranes and steel towers have been placed thereon, and at the Port Richmond terminal there have been installed electrically operated ore-loading machines which cost an additional million dollars. Near by is the McMyler Coal dumper with a capacity of loading two ships every 36 hours. Additional river front developments credited to the great trunk rail lines which use the Port of Philadelphia include two enormous terminals for the reception and storage of perishable food products. One located at Delaware and Oregon Avenues, and the second, covering an area of 23 acres, located on Delaware Avenue between Snyder Avenue and Ritner Street are in proximity to the vessel service of the port and to the rail service adjacent. The size of these plants emphasises the greatness of that volume of perishable food required daily in feeding several millions of people. These are instances of major investments made on the Delaware River within recent date, and to which can be added a number of others, including the completion of a big assembly plant by the Ford Company on the Delaware River, a plant which represents an investment of \$10,000,000 and covers an area of 60 acres. In addition the Baldwin Locomotive Works, which shipped its first engine from the Port of Philadelphia more than 90 years ago, has established a huge plant upon the Delaware River at Eddystone.

Recent Legal Decisions.

A very frequent defence in cases where ships collide with harbour works, piers, or with other vessels, is "unavoidable accident," or as it is sometimes phrased, "inevitable accident." In the recent case we are about to discuss it was argued that where such a defence was stated the defendants could only succeed by showing that the accident could have been avoided by the greatest care and skill on their part. This contention is founded upon the opinion of Lord Esher, M.R., in the "Schwan" and the "Albano" (1892) L.R. (P.D.) 410. But Lord Esher's opinion in that case, is difficult to reconcile with principle and would lead as Mr. Beven points out in the Fourth Edition of his Book on Negligence at p. 1293 to the curious result that a defendant pleading "inevitable accident" would thereby take on himself the obligation of proving considerably greater diligence than if he had limited his defence to a denial of negligence. Further the dictum of Lord Esher was not accepted by Lord Justices Fry and Lopez who were parties to the judgment in the "Schwan" and is not supported by the decision in the "Annot Lyle" L.R., 11 P.D., 114 and the "Indus," L.R., 12 P.D., 46, to which Lord Esher refers and is contrary to the older authorities. All that it is necessary for defendants to establish is that the accident could not have been prevented by the exercise of ordinary skill and diligence.

The facts in the recent case of *Mitchell v. Balgown Steamship Co., Ltd.*, lately decided in the Sheriff Court, Glasgow, were that in October, 1925, the defendants' ship, the ss. "Admiral Codrington," was laid up in the Gareloch under the direction and to the satisfaction of the Pilotage Authority of the Clyde, whose duty it is to assign berths to and to moor ships so laid up; the vessel was fully and correctly found and equipped to the satisfaction of the said Authority; in October, 1926, she went ashore in a gale, but this accident was due to the parting of a ring on the swivel of her port cable and not to any deficiency in her mooring; when she was moored again in October, 1926, she was moored under the above-mentioned Authority and was in every respect as regards position, mooring, equipment, and crew as before said accident, except that for greater safety rings were dispensed with and the cables shackled directly on the swivel; on the afternoon of Monday, 24th January, 1927, a gale began to blow which lasted until the evening of Friday, 28th, and on Wednesday, 26th, Thursday, 27th (especially on Friday 28th, the gale was of unprecedented severity); on Wednesday, 26th January, the ship began to

drag her anchors, but so slightly that the drag was not perceptible to anyone who did not take a bearing, and on Friday, the 28th January, she was struck by a squall of very great violence, dragged her anchors and was eventually driven against and damaged one of the private piers in the Gareloch.

The Court came to the conclusion that the accident could not have been avoided by the exercise of reasonable care and ordinary maritime skill on the part of those in charge of the "Admiral Codrington." The main ground upon which lack of diligence was imputed to the defendants was that having the knowledge as early as Wednesday, the 26th of January, that the ship had begun to drag her anchors, the chief officer failed to communicate with the owners as he should have done, in order that tugs and men might be sent to assist him and the skeleton crew on board to keep the vessel off the shore. Now there was a conflict of evidence as to the extent to which the vessel had dragged her anchors before the afternoon of Wednesday, the 26th of January, but the evidence of the landsmen examined for the plaintiff was considered by the Court as being of less weight on this point than that of the seamen on board the "Admiral Codrington," and the other vessels anchored in the Gareloch who were examined as witnesses for the defendants, and it was therefore held proved that up to Thursday, the 27th of January, the "Admiral Codrington" had dragged her anchors to a minute extent only. The question accordingly arose whether the fact that the vessel had slightly dragged her anchors in three days of stormy weather ought to have suggested to the mind of a careful and prudent seaman that if the gale continued there was reasonable prospect of the ship being blown ashore, and that question which was clearly a technical one of seamanship was put to the Nautical Assessor who sat with the trial judge and was answered by him in the negative. The Court, therefore, definitely found that in fact the collision with the pier could not have been avoided by those in charge of the said vessel, and found in law that said accident having been inevitable the defendants were not liable to the plaintiff in damages.

CANADA AND JAMAICA TO BE LINKED IN NEW STEAMSHIP SERVICE.

According to an announcement by the Montreal Agents of the United Fruit Company, a direct weekly Canada-Jamaica steamship service from Saint John and Halifax to Kingston, Jamaica, will be inaugurated on May 1st by the Company, three ships being placed in the service.

The growing banana trade of the Company in Canada, the desire to bring the food direct and the new trade treaty between the Dominion and the West Indies are the principal reasons for the new venture.

SEAPLANE HARBOUR PLANNED AT TORONTO.

The Toronto Harbour Commission has plans in preparation for the construction on the waterfront at Toronto of one of the finest seaplane and land plane airports on the Continent of North America. It is proposed to locate the landing field, marine railway, hangars and shops on made land on Toronto Island, south of the Western Gap, and the site will include the sandbar which extends towards Hanlan's Point. Though the Board of Control of the City of Toronto deleted from the Harbour Commission estimates an item of \$100,000 for underground wires, marine railways, top dressing and equipment for the field, an item was left in of \$330,000 for central harbour dredging and reclamation work, and the Commission will proceed at once with the making of the necessary land.

Referring to the proposed airport, Brig.-General J. G. Langton, general manager of the Toronto Harbour Commissioners, said: "Our report is not ready yet, and will not be for some time. We put in the item of \$100,000 to place the present current and telephone wires underground, to construct a marine railway and equip the base; but the Board took it out, pending our report. We feel, that the harbour must provide accommodation for seaplanes just as we provide docks for ships. With the whole of the north mining country using seaplanes we must make Toronto a port for such modern methods of transportation."

The facilities planned would enable seaplanes of all sizes to come down in the sheltered waters at Toronto Bay, put ashore mail and passengers at a city dock in close proximity to the new post office, and then be taken by the marine railway into hangars or shops on the sandbar for storage, overhauling, refuelling and repairs.

Harbour Commission capital estimates were passed by the Board of Control totalling \$1,432,500, in accordance with the promise to the Commission two years ago that the city would finance the work until completed. The largest items were for the ship channel bridge, \$375,000, and central harbour reclamation and dredging, \$330,000.

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